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WHAT THE TECHNICAL SCHOOLS EXPECT OF INDUSTRY[1]

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THE topic which the distinguished president of Lehigh University has invited me to discuss on this occasion is "What the Technical Schools Expect of Industry."

Permit me to suggest that before we discuss a "What" we should reflect on and disclose whether there may or may not be a reasonable "Why." That is, we should consider whether there are reasonable grounds on which the men who control the scientific and pedagogical processes and progress in the engineering schools can establish a just claim on the intellectual and financial interests of industry. Permit me to diverge briefly and dispose of this question, in the interest of then being able to more clearly unfold my principal theme.

[1] Address delivered on the occasion of the dedication of the James Ward Packard Laboratory of Mechanical and Electrical Engineering, Lehigh University, October 16, 1930.

The application of the words "industry" and "industries" in this address is to the engineering industries, and these words thus used are inclusive of substantially all collectivities engaged in manufacturing, transportation, generation and distribution of power, production of artificial light, communication of intelligence over distances. These compose the broad foundation which, next to sentiment, ethics and religion, supports our twentieth century civilization. Even agriculture, a basic and pervasive activity, now secures part of its character from these engineering industries through the inventions that have given birth to automobiles, tractors, hard-surfaced roads, manufactured fertilizers; in addition to the older railroad, electric light and power, and telephone industries. We thus are discussing a topic which touches the welfare of every ultimate citizen. The wise administration, the continued unfolding of new aspects, the

prosperity of the engineering industries, are the concern of every individual among all classes of citizens, rich and poor, exalted and lowly, alike. That discloses a responsibility and a scope in the industries sometimes overlooked, which gives one side of the answer to our "why." Engineering works provide the veins, the nerves, the sparkle and the vital functions which vitalize modern civilization. Agriculture continues to provide the food supply. The government has found it necessary to furnish guidance and support for the functions of higher education and research in the latter. Industry is able to cooperate in the support of these functions applied to the former, and better progress can be made where industry embraces its part in the cooperation and by its achievement illumines the features that economically may be supported by government.

With our abundance of opportunities for new or improved utilization of forces and materials and preventing waste of man-hours and natural resources, the prosperity and influence of the industries are bound up in improving on the old, well-beaten, wasteful paths of practice which have been determined solely by empiricism. For the supply of men to be relied on in development—the unfolding of new fields and improvements in the old fields—industry has come to rely more and more on the colleges and particularly the engineering colleges. This is another side of the answer to the "why." Engineering school men are coming more and more into elevated administrative posts where wise administration must be in command, in addition to carrying on in the designing, manufacturing and selling branches of industry. Scientist or engineer can become a great merchant if he has the taste and will to be. The business man who is pure empiricist has proved to be more than 50 per cent. failure. Creative intelligence in management and ability in scientific research are two assets for a people that can not be too highly valued. On our success in stimulating them we may confidently rest our future.

Development in the industries is largely the result of additional applications of well-established science or (less frequently, but often most fruitfully) of applications of newly discovered facts or modes of reasoning. For making the discoveries, industrial society must largely rely on the school men. The universities in all their branches, including the engineering schools, are educational institutions and the making of men (a pedagogical process) is a primary function for them, but research is an important parallel function both as a part of the pedagogical process and as a means for testing empirical philosophies and extending knowledge by discovery. The engineering schools are proved to be capable and successful in the prosecution of these two functions; the products of these functions are highly important to the financial prosperity of industry. This is a third side of the answer to our "why." We of the engineering schools believe that these *a priori* grounds make a sound reason for industry to contribute financially for the purpose of aiding the engineering schools to improvement in prosecuting these functions, but to direct such contributions only to such schools as are qualified by the possession of the spirit of progress.

Engineering education has for its end result the attainment of knowledge of the ways of nature and man, intelligence in the command of circumstances, resourcefulness in the use of knowledge, a spirit of investigation into the phenomena of nature, powers of exact analysis and synthesis, and an instinctive sense of the relative fitness of things. The days of the old-time empiricists who carried on according to the ways of their fathers solely because their fathers did so before them are almost gone in engineering and the engineering industries. The days of intelligent application of science and the now known principles of economics have dawned. The necessity of widening the applications of science and of farther disclosing applicable economic principles is recognized in engineering and has become a factor of engineering education. The pinch of necessity seems always to produce improved intelligence; which is a corollary of the theorem that the fittest in intelligence survive and radiate their influence to the ends of the earth. No education is directed to a finer end.

Before going farther it is reasonable to search our souls with the inquiry whether we of the engineering schools are performing the two functions of the making of men and of prosecuting research in such a devoted and impartial manner that support of the performance from industry at large may be justly expected. Have we thrown empiricism sufficiently to the winds in our processes and joined the band of scientists and economists who pursue, disclose and correlate all facts, endeavor to discover new facts, and fit all together in an intellectual and physical embodiment without being overly-trammeled by tradition? If we have not, then we must step forward under internal compulsion before relying much on external support.

Our alumni and others of either sex who advise their sons and the sons of friends to become our students have the right to inquire into our ways. They may ask whether we thoughtfully assay our pedagogical methods and strive to elevate their quality; whether we suitably recognize those distinctions be-

tween students which arise from present differences in intellectual maturity and speed, and encourage the development of each student to his fullest individual capacity; whether we encourage exercise of each individual student's self-reliance and resourcefulness; whether we secure reasonably complete intellectual contact between students and faculties to aid in enriching the sense of responsibility, loyalty and character of every student; whether we utilize a fundamental and scientific approach in the subjects pertaining to our teaching and also in the formulation of our curricula; whether we appreciate the importance of placing empiricism in engineering in a less important place in our teaching and utilizing it only to fill up gaps left by the inadequacy of the organized knowledge known as science; whether we are achieving a closer articulation of the principles of economics with those of science; whether we are developing a sound investigative spirit in all our students; whether we are associating formal scientific research with mature students' work so that students may know by experience the effectiveness of a sound marshalling of facts as a basis of judgment instead of much that goes by the name of judgment but in reality is merely guessing; whether we are bestowing wise selection and supervision on younger members of teaching staffs and are seeking to establish greater selective rewards in the way of distinction and financial compensation for established achievement by staff members; whether we all embrace the golden tenet that pedagogy and scientific research should be bedmates in engineering education.

Frankly facing the situation, we can see the need for improvement in the aims and practices of the engineering schools. Nevertheless, their educational ideals and practices are unexcelled in the field of higher education in the United States. Our logically coherent curricular programs, set out in sufficient variants to satisfy the intellectual tastes of the variety of students who choose to enter the field of engineering, associated with freedom of election and substitution by individuals who have reached the maturity to demonstrate fitness for making their own "case," have been a steadying and rectifying influence in national higher education. Moreover, we know that improvement in our processes is being made and will continue to progress.

Although such questions as those enumerated in the second preceding paragraph may be asked justly by patrons of our students and supporters of our engineering schools, there is nevertheless an amplitude of evidence of successful results rising out of our performance to plentifully answer our "why" and justify a claim for selective support far larger than has yet been extended to engineering schools by the industries. This is shown by the reports of the recent comprehensive analysis of aims, processes and results of the engineering schools made by committees of the faculties under a coordinating committee (called the Board of Investigation and Coordination) which was appointed by the Society for the Promotion of Engineering Education. Financial support supplied by the Carnegie Corporation for a director of investigation with his aides and headquarters made this important study possible.

Time lacks for me to give a full exposition of the undischarged debt of industry in this country to the engineering schools. I must now content myself with a few briefly stated illustrations.

Aside from distinguished inventors and executives who laid the early part of the structure, many of whom continue in great achievements but whose days of youthful education were over before the engineering schools sensed the importance of industrial development, it is a matter of commonplace observation of the electrical industries that a notable proportion of the men in executive or developmental positions who are now advancing these industries to greater service, influence and prosperity are alumni of engineering schools. As far as these industries are of value to the citizenry of this country by increasing the comforts and conveniences of life and by enlarging the hours of leisure, so far the citizenry have a debt to these men and a debt to the engineering schools from which many of the men secured education and stimulation in their youthful days. As far as the vision of these men has contributed to the prosperity of the industries, these industries, their employees and stockholders also owe some debt to the engineering schools for the contribution of their part in the education of these men.

The executive and operating affairs of many of our most prosperous and serviceable railroads are in the hands of men whose youthful schooling was in some engineering school and from the fertilizing influence of which the individual's present ideals and ambitions may have been aroused. The steel industries are slowly turning from empiricism to engineering science for the betterment of their methods. The textile industries located in New England might well have been in a happier condition to-day, had they not notably lacked in the scientific spirit characterizing engineering in this generation.

Mr. James W. Gerard (former American ambassador to Germany) recently came forth with a list of names of sixty-four men who, he was reported to allege, "rule the United States." The list was marshalled in argument supporting a special cause and

Americans speedily denied the possession of his selection of the power to rule this nation. However, it is sufficient for our own purpose here to agree that each of the names in that list attaches to a man of magnificent achievement who is in high and useful influence in finance, commerce, industry or social relations; and that every one, whatever his primary leaning may be, has had a large influence directly or indirectly in establishing, widening or increasing utility of the output of industry in this country. It is a pertinent fact that 17 per cent. of these men are engineering school men. The proportion of engineering school alumni among the total of ambitious men in this country is much smaller than 17 per cent., and some decades ago, when these men on Mr. Gerard's list were entering industrial life, the proportion was still smaller. It appears from this list, as far as such a list may have pragmatical weight, that the engineering school processes in education have a proved vitality. Creative intelligence in management is a triumphant but elusive fairy; however, she is no will-o'-the-wisp that can not be captured as an embodiment. In fact, she seems to favor association with the educational processes which characterize our engineering schools.

With this academic year I enter upon my fortieth consecutive year as head of a department of electrical engineering, first at the University of Wisconsin, beginning when electrical engineering instruction was established in that institution, and latterly at the Massachusetts Institute of Technology. This long period of employment in these two great universities has afforded unrivaled opportunities for observation and reflection on the development and status of engineering education. In the earlier days, the engineering schools were looked upon askance alike by the industries (on the ground of alleged lack of "practicalness"), and by the so-called liberal colleges (on the ground of alleged "narrowness"). Among the engineering faculties we were far from agreement on aims and differed radically amongst ourselves regarding the relative weight to be attached to exact science, scientific research and formulated economics, as supported by one group, and empirical engineering practice as supported by another group. Latterly these fogs have blown to one side. Experience has disclosed the relative merits and demerits of the principles supported by the different parties in engineering education.

Our vision now is clearer and more far-reaching. Our educational processes stand unexcelled in results and in repute. Fully awakened to the importance in education of utilizing scientific research, we emphasize the science, scientific research and economics in our curricula. We use empirical practice as material out of which to build illustrations and contrasts among the present applications of scientific methods in engineering, to demonstrate possibilities of the betterment of practice through the fruits of research, and to map paths that may lead to such fruits if unswervingly followed. Influences of this nature, though then quite crude, are the influences under which were placed as students that 17 per cent. of Mr. Gerard's list who are engineering school men, considering one by one these men and the engineering schools in which they studied.

In the engineering schools, we believe that engineering is second only to preventive medicine in influences which improve the comforts of populations and widen to all individuals the opportunities for desirable living. We men of the engineering faculties believe that there is a steadily enhanced popular approval of (1) our pedagogical ideals, (2) our methods of scientific research, and (3) our linking the one with the other for the purpose of making scientific inquiry an incident part of man's education in preparation for an active, resourceful and creative life. The emphasis on scientific research is not wholly to train research men in the technical sense of cloistered laboratory discoveries, but the emphasis in the engineering schools is for the wholesome pedagogical influence which breeds an investigatory spirit. Engineering schools are in fact fitting a due proportion of men for scientific research of high order, but through their methods they are likewise fitting for the engineering industries men who are capable of ultimately assuming with distinction posts in scientific designing, manufacturing, salesmanship and administration according to the tastes and maturing experience of the individuals.

It also appears to us of the engineering schools that the direct incidence of our former students on the development of the industries has been for the good of the industries and for the people of the country. If the foregoing interpretations are correct, and we believe them to be, we have every reason to expect from the industries a fuller recognition than has yet been accorded. *Well-directed recognition will be approved by the people of this country, who (broadly speaking) are the consumers of industrial products and many of whom are stockholders. Well-considered support of the engineering schools by the industries is sentimentally as well as legally sound.*

Specifically and not exclusively, the engineering schools expect of industry many things, as industry on the other hand has come to expect many things of the engineering schools. Differences defined by territorial relations, industrial unities and scopes of individual schools arise to modify whatever claims of

expectation are put forward. However, I will risk some categorical suggestions. These are in somewhat dogmatic form but are expressed with a full sense of the friendly relations that exist between the engineering school faculties and leaders of industry, to an extent that is fast bringing us to see eye to eye on educational questions.

The engineering schools expect industry to recognize the duty of the schools (pertaining to them as educational institutions) of independence in thought, in subjects and methods of research, and in opinions. In return the faculties should recognize a duty to refrain from spreading inadequately founded opinions and from dogmatizing in controversial fields.

The engineering schools expect industry to recognize the importance of independent creative scientific research as part of the life of the faculties and students and to support it with contributions of money and counsel made to those schools that are adequately manned and equipped, to the end that additional knowledge may be disclosed out of which industry may forge new applications; and also to recognize the importance of such research as a pedagogical instrument in those schools that are manned and equipped to properly carry it on. Special investigations and researches for an industry that may be carried out in a school with free relation to students and with the understanding that the results may be published may be mutually useful to school and industry, even if a staff adequate for consecutive work on independent research is not available. Having routine tests made, and having special confidential researches carried on, in the engineering school laboratories, is a privilege that industry may claim and expect to be allowed, but this absorbs the intellectual power of members of the faculty and the time of equipment without recompense through student relations or publication of results; and this should be compensated for by money contributions which may be applied to independent research carried on in contact with well-advanced students.

The engineering schools expect large industrial establishments to pay more attention, in their own interest, to the articulation of recent graduates into the industrial work for which they are employed. With few exceptions the present practice is to fit these new employees into places requiring very limited needs, and to make no provision for such employees to gain (except by chance) an understanding of the accomplishments expected of them, thus leaving them "wallowing around" for months without light or leadership which often ends in atrophied resourcefulness and ambition. Supporting the use in the larger engineering schools of formal curricular enterprises led by engineers from industry, like the senior Colloquia in electrical engineering at the Massachusetts Institute of Technology, would fruitfully serve in improving this situation.

The engineering schools expect that the personnel problem of employing young men who are on the eve of completing formal study in the schools will be dealt with by the employing agents of the industries in a judicious and discriminating manner.

The engineering schools expect to clasp the hand of cooperation and not of domination where the employees of industry contact with engineering school faculties or students.

The engineering schools expect that leading men in industrial organizations will take cognizance personally of these needs to the end that the tenets may be vitalized; that dominant industries will recognize a special interest in supporting these tenets; and that associations of industries will also recognize a cooperative responsibility.

The engineering schools expect that industry will aid in laying before the public a fair statement of the public interest in continued industrial development and invention, and the need of maintaining independent research in the engineering schools in order that a stream of results may be available as raw material out of which to mould further industrial development and invention; to the end that the public may come to realize the propriety of industry making contributions of generous size to selected engineering schools for the support of independent research in those schools.

It is also reasonable to expect that men in industries will aid by directing to the engineering schools suitable young men who as students will persistently maintain high scholastic and character levels; who also possess at least incipiently appropriate qualities of personality and ambition, including fixedness of purpose.

The research relations between the engineering schools and the industries are being aided by the division of engineering and industrial research of the National Research Council. Industrial executives are giving increasing recognition to the value of research as a tool of modern industry. Economic pressure arising from competition is driving many industries into extended research activities as a protective and progressive measure. The increase from 500 definite industrial research laboratories in 1921 to over 1,500 in 1930 weaves the picture of this new economic trend. Small firms which are not prepared to create individual research centers for themselves can carry on by means of industrial fellowships in laboratory or-

ganizations maintained by educational institutions or government departments, or by means of research laboratories under the control of their own trade associations. On account of the development now in progress, the National Research Council Division referred to is appropriately turning its promotional efforts from "why do research" to "how do research," and plans are under consideration for bridging the gap between industry and educational institutions by means of conferences between leading institutions and industrial executives—also bringing the trade associations into the plan because they undoubtedly have a helpful influence for small companies.

The Division already has examples of such endeavors. Thus, in the welding field some ten leading institutions are undertaking investigational work of specific problems with coordination through an appropriate committee. Specimens needed in the investigational work are made up by industry under the exact conditions required by the laboratories. Special apparatus is supplied where needed. Some of the smaller companies, and even some of the larger ones, will find that for certain types of work the educational institutions will return more accomplishment for the research dollar than can be obtained in any other manner. But it must be remembered, in educational institutions and in industry, that mere projects of testing are not research, while it is the latter which brings progress and prosperity to industry.

The relation between any typical industry and the engineering schools can not be nationally uniform or nation-wide. Selectivity and discrimination (in the sense of recognition of fitness) are necessary to avoid waste of money and effort in cooperative relations which grow up between the industries and the engineering schools. In the engineering schools, we should aim to make our efforts at industrial cooperation primarily with those industries which have establishments within nearby territory and whose interests lie principally within the range of our individual school curricula and equipment, but the sources of our students may be world-wide and the employment of men who take our degrees may be nationally spread. The engineering schools expect individual industries to give their cooperation primarily for their own welfare, but additionally because it is for the best interest of processes of higher education which associate generally with the industrial welfare of the country. The engineering faculties devote their lives to work of beneficial interest to the industries and it is reasonable for the faculties to expect constructive cooperation and aid from the industries.

OBITUARY

WILLIAM DILLER MATTHEW, PALEONTOLOGIST

(1871–1930)

THE death of William Diller Matthew on September 24, 1930, cut short at the height of his career a man who had contributed immensely to the science of paleontology, one who realized the value of this science for the philosophy and art of human living and who was in the midst of a sustained and highly successful effort to open wide its broad fields, especially to great numbers of his own well-trained students.

In 1894 Matthew was a red-cheeked Canadian youth in the department of geology at Columbia. His main interests at that time were in crystallography, in trilobites and in the structure of the intrusive and effusive rocks of his native country around St. John, New Brunswick. His father, George F. Matthew, was an amateur geologist in the best sense, since he was a recognized authority on the geology, fossil plants and early amphibian footprints of New Brunswick. His mother successfully reared a large or "old-fashioned" family and imparted to all her children her irrepressible cheer and good humor, as well as her high ideals of service. Fire consumed the elder Matthew's collection of fossils and his scientific library; but he set to work to build them up again. The son was a young man of almost Spartan simplicity of life: frugal and self-denying but early learning to achieve excellent results with slender resources.

With such a background the young Matthew, after obtaining his doctorate at Columbia in 1895, came to the American Museum of Natural History at the invitation of Professor Henry Fairfield Osborn to be a scientific assistant in the then young department of vertebrate paleontology. His first big task was to go down to Philadelphia to catalogue and pack up for shipment the great private collection of vertebrate fossils which had been amassed by Professor E. D. Cope, and had recently been sold to the American Museum. In this way Matthew gained his first extensive contact with Cope's life-work and collection. During the next thirty-five years it was his lot to catalogue and identify tens of thousands of vertebrate fossils for the ever-growing collections of which the Cope collection was the foundation. More cautious than Cope and far more critical, with the advantage of great stores of additional material, he corrected, revised and extended Cope's work in many

fields, conserving and strengthening as much as he reasonably could of Cope's results. For instance, in all his extensive researches on the classification of the Eocene carnivores he clung tenaciously to Cope's definition of the Creodonta, which had been so framed as to include both the typical specialized creodonts and their differently specialized relatives, the ancestors of the higher carnivores. This was not because he doubted the ancestral kinship of the miacid creodonts to the higher carnivores but simply because, like Cope, he was a stout defender of the "group method" of classification, which insists on the formal definition of groups of related organisms that possess in common the characters cited in the definition, this method being in opposition to the "phylogenetic method," which defines "phyla" according to their supposed trends of evolution and which includes in these phyla even the earliest and little-differentiated representatives that have not yet acquired all the visible characteristics of their descendants. For example, the earliest so-called "horse" (*Eohippus*) is so closely related to the earliest so-called tapir (*Systemodon*) that even Matthew and his colleague Walter Granger have found it difficult to distinguish the molar teeth of certain species of *Eohippus* from those of a certain species of *Systemodon* (=*Homogolax*). From this and other evidence Matthew contended that these two closely related genera along with many other related forms of Eocene perissodactyls, including the ancestors of the paleotheres and rhinoceroses, ought to have been referred to a "horizontal" family, the Lophiodontidae. This family would have been defined by the retention of many primitive dental and skeletal characters which were subsequently lost by their divergent descendants the paleotheres, horses, titanotheres, rhinoceroses, tapirs, etc.

Another instance of his conservative progressiveness may be found in his most widely known work, "Climate and Evolution" (1915). Being a student of Alfred Russell Wallace's works on geographic distribution, he sided with that great naturalist in opposing those who lightly reconstructed "land-bridges" across the oceans of any and every geologic epoch in order to account for the presence of related animals and plants on opposite shores of ocean barriers. From his vast and intimate knowledge of the fossil record of the vertebrates, he was able to show that many groups whose representatives are now found dispersed in far distant tropical and southern continents are the specialized descendants of known fossil types which in the Eocene and later epochs were inhabitants of the northern lands. His excellent distribution maps were "North Polar projections" of the continental land masses, upon which was plotted: first, the distribution of the Eocene and later ancestors of the horses, tapirs, rhinoceroses, camels, pigs, ruminants, dogs, cats, etc., which were all known only in the northern hemisphere; second, the present distribution of the scattered representatives of many of these families in tropical and southern land masses. His inference was that these forms had originated in the northern hemisphere, had then spread southward into the tropical and southern countries, while the original stock often became extinct in the northern homeland.

On the geologic side he adopted the theory of isostasy, in so far as it was developed at the time. According to this theory, the continents and oceans are held in balance in such a way that only minor oscillations of level have occurred; thus, although the land was at intervals submerged under shallow invasions of the sea, while at other times the continents emerged to higher levels, yet the main continental masses have remained substantially intact, at least throughout the period covered by the records of vertebrate life. In order to account for the first colonization by mammals of continental islands, including Madagascar, Australia, New Zealand, he followed Wallace in evoking the agency of those "natural rafts," which emerge in great numbers from continental rivers and carry sometimes a stray small mammal. Once in a million or more chances, he argued, this castaway might be a gravid female whose progeny could subsequently colonize the whole island. He cited the evidence that tended to support the view that even the most gigantic Australian marsupials had been derived eventually from small arboreal ancestors, which were the only kind that might be conceived to be capable of living in a tangled mass of vegetation during its long drift across the sea and through subsequent perils of landing on a strange shore.

Thus Matthew came to deny the validity not only of all the supposed sunken "land-bridges" across the Atlantic and Pacific which had been evoked by various authors, but also the supposed former connections of South Africa, Australia and South America with the Antarctic continent. Accordingly he ascribed to "parallelism" the rather striking resemblances of the extinct "sparassodonts" of Patagonia with the existing thylacines of Tasmania.

Whatever may be the ultimate verdict of science upon these features of his zoogeographical theory, it is somewhat unfortunate that this more or less debatable aspect of his work should have been discussed by dozens of writers of varying competence, while his immense contributions to the orderly development of mammalian paleontology were really well

known only to those two or three specialists who, with fossil specimens in hand, wanted to identify their material by comparison with his excellent descriptions and figures.

The greater part of his scientific writings deals with the revision of mammalian fossil faunae, including the Basal Eocene Puerco and Torrejon, the Lower Eocene Wasatch, the Middle Eocene Bridger formations of the Eocene and many horizons of the Oligocene and later Tertiary. To all these faunae he contributed extensive technical reports or memoirs. His faunal lists of the Tertiary horizons of Western North America, though embodying the work of his predecessors and colleagues, nevertheless represented his own labors in identifying thousands of fossil specimens; they were also based upon his personal studies of the precise geologic level of specimens collected in field parties under his direction.

He was always a geologist as well as a paleontologist and geological considerations occupy a good share of his published writings. As a result of his field and museum experience he successfully attacked (1899, 1901) the theory that the deposits of the supposed ancient "Lake Basins" of the West had been laid down in great lakes, showing that the geological and paleontological facts indicated rather the derivation of these formations by flood-plain playa and aeolian deposition.

His conclusion that the Basal Eocene formations of New Mexico and Wyoming represented a very long period of time (to which he gave the name Paleocene) between the Uppermost Cretaceous and the true Eocene has recently been confirmed by the intensive explorations carried on in northwestern Wyoming by parties from Princeton University.[1]

Owing to the great scarcity of fossil mammals, except in a very few museums, and to the necessarily technical nature of most of his work, Dr. Matthew's greatest discoveries concerning the evolution of the mammals were known at first hand only to his immediate colleagues and to a very few specialists scattered over a world which, for the most part, is impervious to paleontological science. But, as practically his entire scientific career was spent amid the most compelling evidences of evolution, it is not surprising that when he did write for the public on the subject he was able to do so with conviction and with authority. His vigorous honesty and cautious testing both of fact and of inference inspired confidence in the reader. Among the most important of these writings on evolution were his popular "guide" to the evolution of the horse[2] and his admirable articles on the evolution of the horse family and of the dog family,[3] his summary of the evolution of Eocene mammals in the Proceedings of the Zoological Society of London (1928), and especially his handbook "Outline and General Principles of the History of Life."[4]

In 1927 Dr. Matthew accepted the call of the University of California and went there to be head of the department of geology, professor of paleontology and director of the paleontological museum. He was brilliantly successful in attracting very large numbers of students to his lectures in spite of the difficulty of his courses; he also stimulated new exploration and research and attracted young men of great promise into the field of paleontology. In the summer months he came back to his old collections in the American Museum to continue and complete his monograph on the Paleocene mammals. But in the midst of all these successful activities he was interrupted in May of 1930 by the first serious indications of the grave illness to which he finally succumbed after a long fight. He is survived by his widow, two daughters and a young son.

In fine, Dr. Matthew's greatest contributions to the cause of science and enlightenment may be summarized as follows:

He identified, catalogued and kept in close touch with tens of thousands of specimens of fossil mammals. He took part in and directed field exploration in many western localities and in Florida, and made extended studies of vertebrates in the museums of Europe and in the field in Mongolia, Java and elsewhere. With this background of practical experience he compiled, and repeatedly revised and extended, faunal lists of all the Tertiary horizons of Western North America and took a prominent part in correlating the horizons of different localities with each other and with the faunae of Europe, Asia and other regions. He published a long series of memoirs, bulletins, *novitates,* etc., on the fossil mammalian faunae of North America, especially those of the Puerco and Torrejon, Tiffany, Wasatch, Bridger, White River, Lower Harrison, Rosebud, Sheep Creek and several later formations. In these reports he dealt effectively with the stratigraphic relations of the formation, mode of deposition, ecology of the various groups, revision of species and genera, osteology and allied topics.

In the course of the foregoing and other work he made significant contributions to the classification of mammals and knowledge of phylogeny in nearly all the orders and suborders of mammals, but especially the Creodonta, Arctoidea, Aleuroidea, Insectivora,

[1] Jepsen, G. L., *Proc. Amer. Philos. Soc.*, lxix, p. 467, map.

[2] *Quarterly Review of Biology*, Vol. 1, No. 2, April, 1926.

[3] *Journal of Mammalogy*, Vol. 11, No. 2, May, 1930.

[4] University of California Publications, Syllabus No. 213, 1928.

Rodentia, plesiadapids, lemuroids, tarsioids, ganodonts, teniodonts, Xenarthra, Condylarthra, Taligrada, Amblypoda, Hippoidea, Rhinocerotoidea, bunodonts, bunoselenodonts, Tylopoda, hypertraguloids, Pecora. Even in a much fuller review of this aspect of his work (to be published elsewhere) it has been impossible to do more than touch upon a few of the evolutionary problems which he either definitely solved or left with significant enrichment. It must suffice in this place to state that the younger generation of American paleontologists, which is now fortunately coming forward, is already finding that Dr. Matthew, while giving final answers of fact to thousands of specific questions, has also bequeathed to them other thousands of problems that will challenge their best efforts for a lifetime.

WILLIAM K. GREGORY

FRITZ PREGL

PROFESSOR FRITZ PREGL, head of the Institute of Medical Chemistry at the University of Graz, Austria, died quite unexpectedly on December 13 at the age of 61. Professor Pregl was the originator of the methods of quantitative organic microanalysis bearing his name, which have found so widespread application in recent years. In recognition of the eminent practical importance of this work he was awarded the Nobel Prize in Chemistry in 1923. Pregl originally received a medical training and was actually practising in ophthalmology, but later turned back to the preclinical sciences and became interested in certain physiological-chemical problems. This inclination brought him in contact with K. B. Hofmann, Abderhalden and Emil Fischer and resulted in a number of publications on various subjects (bile acids, composition of proteins, starch). In the course of an investigation on bile acids lack of material put before him the choice of either abandoning the problem or of inventing new methods of analysis. Within a few years (1911–1914) he was able to substitute for practically all the conventional methods of quantitative organic analysis equivalent micromethods requiring only 3 to 5 mg. of substance and involving substantial savings of time and reagents. His work drew considerable interest in the scientific world and ever since then students of all nationalities, some of them renowned investigators, gathered in his laboratory to acquire the special technique and "microchemical asepsis" of manipulation. In this country a number of chemists will remember with gratitude the hours spent in his institute, not only because of the knowledge gained, but also for the contact with an outstanding and original personality of fine human qualities.

O. W.

MEMORIALS

As a memorial to the late Louis Agassiz Fuertes, who until his death in 1927 was generally recognized as America's foremost painter of birds, the Field Museum of Natural History has published in a limited edition an album of reproductions in colors of thirty-two of his finest pictures of birds and mammals. The paintings selected for this portfolio represent the last work of the artist, having been made in Africa while he was a member of the Chicago *Daily News* Field Museum Abyssinian Expedition of 1926–27. Mr. Fuertes was killed in an automobile accident shortly after his return to this country from that expedition. The originals of the paintings were purchased and presented to Field Museum by C. Suydam Cutting, of New York, who was also a member of the expedition. Mr. Cutting in addition paid the cost of the publication of the memorial album. The portfolio is of large size, the plates being eight by ten inches with a ten-inch margin. The album has a preface about Fuertes, the man and his work, written by Dr. Wilfred H. Osgood, the museum's curator of zoology, who was leader of the Abyssinian expedition.

WE learn from the *Journal* of the American Medical Association that the memory of Professor Laveran, who discovered the hematozoon of malaria, and to whom a monument was unveiled last spring at Constantine during the ceremonies commemorating the centenary of the conquest of Algeria, has again been honored at Paris by commemorative ceremonies held at the military hospital of the Ecole du Val-de-Grâce, where he was professor until he reached the army age for retirement, after which he was director of a laboratory at the Institut Pasteur until his death. The ceremonies were held in the great hall of the school. Dr. Roux, director of the Institut Pasteur, presided. Professor Sieur, president of the alumni association of the Ecole de santé militaire du Val-de-Grâce, expressed the thanks of the association to those who had subscribed to the monument. Mr. Calmette gave an account of the life of Laveran and of his discovery. Addresses were delivered by Troussaint, a former coworker of Laveran; by Marchoux, and by Rouvillois, the director of the school. An historical niche was established in the school, in which a glass case encloses the microscope and the observation records of Laveran. Then the audience proceeded to a spot in front of the entrance to the school, which will bear henceforth the name of "Place du docteur Laveran." A commemorative tablet was affixed to the house in which Laveran lived.

RECENT DEATHS

BERNARD BARHAM WOODWARD, librarian and bibliographer at the British Museum of Natural History until his retirement in 1920, died on November 17 at

the age of seventy-seven years. We learn from the London *Times* that his interest in natural history was not confined to librarianship, for he conducted a number of researches on the borderline between zoology and geology, a subject in which his uncle, the late Dr. Henry Woodward, formerly keeper of geology in the British Museum, and his brother, the late Mr. H. B. Woodward, of the Geological Survey, both achieved distinction.

AN Associated Press dispatch reports that Dr. Werner Borchardt, of the Hamburg Tropical Institute, is believed to have lost his life while making observations of an eruption of the Volcano Merapi in Sumatra. Dr. Borchardt was about thirty years old and had been loaned by the Hamburg Institute for a year to the Sumatra Institute to carry out research work on the influence of temperature on the blood and kindred subjects.

SCIENTIFIC EVENTS

THE BRITISH ASSOCIATION OF SCIENTIFIC WORKERS

THE Association of Scientific Workers, according to a note in *Nature*, in spite of the financial stringency with which it, like other good causes, is afflicted, still adds to its record of achievement. During the past few months it has prepared, and submitted to the Royal Commission on the Civil Service, a formidable body of evidence dealing with the position of the scientific civil servant *vis-à-vis* his administrative colleague, and advocating the unification of all the state scientific services under a Ministry of Science. At the same time, the association has prepared an index of references to science and cognate matters in the parliamentary debates, and through its general secretary, Major A. G. Church, M.P., has formed a parliamentary science committee. This committee, consisting of members of both houses and all parties, meets periodically to hear the views of acknowledged experts on scientific questions which bear on public affairs.

Some years ago the association issued an appeal for members, in the form of a letter signed by some of the most prominent men of science in Great Britain. This letter was sent to about 20,000 scientific workers, and resulted in a large increase of membership. At the present time the association is sending out another such appeal, on a much more elaborate scale. It consists of a sixteen-page booklet entitled "The Profession of Science," containing articles by Sir Richard Gregory, Professor Julian Huxley, and others, with messages from Sir Ernest Rutherford, Sir William Bragg, the Right Honorable W. G. A. Ormsby-Gore and Professor F. G. Donnan, and a preface by Sir Daniel Hall as president of the association. The booklet is being sent to 25,000 scientific workers, and at the same time a card index of qualified scientific men is being prepared, with the intention of preserving it and keeping it continually up-to-date. In this way, as a by-product of the association's own propagandist activities, information is being collected which will prove invaluable when it becomes possible to create an authoritative register of the profession of science, such as the professions of law, medicine, dental surgery and teaching already possess. Work on this card index has been in progress for four weeks, and it is already clear that the figure of 25,000 falls considerably short of the total of qualified workers in Great Britain.

BIRD SANCTUARIES

PURCHASE of land for migratory game-bird refuges in four states was authorized on December 18 by the Migratory Bird Conservation Commission.

The four proposed refuges had been surveyed previously by biologists and land valuation experts of the Biological Survey, and the Department of Agriculture had approved their acquisition as units in the nation-wide system of refuges authorized by the Congress.

The new Florida refuge will extend about 12 miles along Apalachee Bay, in Wakulla, Jefferson and Taylor counties, and will be known as the St. Marks Migratory Bird Refuge. It will contain 13,981 acres.

The new purchases in California will add 8,982 acres to the Salton Sea Wild Life Refuge, created by Executive Order of November 25, 1930. The purchase authorized, together with the public lands recently set aside by the President, will create a refuge of more than 24,715 acres for waterfowl and other migrants in the Imperial Valley.

The Swanquarter Migratory Bird Refuge will be established in North Carolina under the new authorization. This will consist of 11,778 acres in Hyde County, on Pamlico Sound, and together with intermingled areas of water will make an administrative unit of about 20,000 acres.

In the sandhills of western Nebraska the purchase of 39,038 acres is authorized for the establishment of a migratory bird refuge in an area resorted to by great numbers of waterfowl in the nesting season. This is in Garden County and will be known as the Crescent Lake Migratory Bird Refuge.

The Migratory Bird Conservation Commission, which was created by the act providing for a ten-year

program of refuge acquisition consists of Secretary Hyde, of the Department of Agriculture; Secretary Lamont, of the Department of Commerce; Secretary Wilbur, of the Department of the Interior; Senator Norbeck, of South Dakota; Senator Hawes, of Missouri; Representative Ackerman, of New Jersey, and Representative McReynolds, of Tennessee. Rudolph Dieffenbach, in charge of land acquisitions of the Bureau of Biological Survey, is secretary of the commission.

The new purchases authorized, together with those previously approved by the commission, and those established by executive orders since the inception on July 1, 1929, of work under the Migratory Bird Conservation Act, make a total of 158,167 acres that will become inviolate sanctuaries for the conservation of migratory birds.

The ultimate objective is the establishment of one or more such refuges in each state of the union. The act authorizes annual appropriations for ten years for the purpose of carrying out this objective.

DEDICATION OF McGREGORY HALL OF CHEMISTRY AT COLGATE UNIVERSITY

BLESSED with about as fine weather as the Chenango Valley can afford at this time of the year, the formal dedication of McGregory Hall of Chemistry at Colgate University, Hamilton, N. Y., took place on December 5 and 6, 1930. Delegates from thirty-four colleges, universities and scientific societies spent the best part of two days as guests of the university.

The formal program began Friday at 2:00, following the traditional academic procession to McGregory Hall, when President George Barton Cutten paid a tribute to the memory of Miss Evelyn Colgate, who provided by the terms of her will the original funds toward the erection of the laboratory. To this sum, her parents, Dr. and Mrs. James C. Colgate, of New York, added the funds necessary to complete and equip the structure. Dr. Cutten also paid a tribute to Professor Joseph Frank McGregory, in whose honor the laboratory is named. Dr. McGregory was the first professor of chemistry at Colgate and for forty-five years has directed the destiny of the department.

The first speaker on the program was Dean Edward Ellery, an alumnus of Colgate, a former member of the teaching staff and now dean of the faculty of Union College. In a brilliant address Dr. Ellery gave a historical account of "Chemistry at Colgate," with many interesting references to his former teacher.

The address of dedication was then given by President Livingston Farrand, of Cornell University. Dr. Farrand stressed the necessity of cooperation between the sciences, giving many examples from his rich experiences as a physician and university administrator.

With the singing of the Alma Mater, the delegates and friends were taken on a tour of inspection of the laboratory, ending in the museum where tea was served by the ladies of the chemistry staff.

At 6:30 P. M. a "speechless" dedication dinner was served at Colgate Inn for the delegates, university trustees and other invited guests. Following the dinner, everybody came back to McGregory Hall for a public address by Dr. Harrison E. Howe on "Chemistry Remaking the World." Dr. Howe made use of his familiar black bag and really astounded his audience by his collection of products of the chemist's art. Dr. Howe was introduced by his friend of many years, Dr. J. F. McGregory.

Saturday morning Alpha Nu Chapter of Alpha Chi Sigma at Colgate was host at a breakfast at the College Commons. The rest of the morning was spent in a conference on chemical education, at which Dr. R. C. Roberts, head of the department, presided. Dr. Neil E. Gordon gave the first address on "Chemical Education for Teaching and Research." He told of the origin of the Division of Chemical Education and made a strong plea for cooperation between chemists as well as other scientists in developing educational methods and courses in chemistry. He also gave an intimate view of the work being done at the Johns Hopkins University in the selection and training of men for chemistry.

"Chemical Education for Medicine" was ably handled by Dr. Walter R. Bloor, associate dean of the school of medicine and dentistry of the University of Rochester. Dr. Bloor indicated the difficulties and intricacies of medical training and the demand for sound training in chemistry for the prospective medical student.

The closing address of the conference and the dedication program was given by Dr. Edward R. Weidlein, director of the Mellon Institute of Industrial Research, on "Chemical Education for Industry." Dr. Weidlein pointed out the qualifications necessary for a successful career in industrial chemistry, giving intimate experiences in this connection at the institute. He stressed the importance of better training in chemistry, a knowledge of economics, the ability to use the English language, a personality that gets along with people and last of all the necessity of hard, painstaking work.

R. C. ROBERTS

POPULAR SCIENCE MONTHLY AWARD

DR. GEORGE H. WHIPPLE, dean and professor of pathology of the School of Medicine and Dentistry at the University of Rochester, and Dr. George R. Minot, professor of medicine in the Harvard Medical School, discoverers of the value of liver and liver extract as a treatment for pernicious anemia, formerly incurable, received on December 18 at a dinner at the University Club, New York, a $10,000 prize offered by *The Popular Science Monthly* for "the current achievement in science of greatest benefit to the public." The awards and gold medals were presented by Dr. Robert A. Millikan, chairman of the executive council of the California Institute of Technology, and responses were made by Dr. Minot and Dr. Whipple. Addresses were then made by Dr. Simon Flexner, director of the Laboratories of the Rockefeller Institute for Medical Research, and by Dr. Millikan. According to a press report Dr. Millikan said:

> Only that is of most potential value to the human race which represents a fundamental increase in human knowledge not only in one way but in many ways. Every bit of our material civilization to-day can be traced to the discarding by Galileo and Newton of the a priori method of approaching reality and substituting for it the method of empiric investigation.
>
> Until twelve years ago we lagged far behind other nations of the world in fundamental science. That was inevitable as long as we focused our attention on the immediate application of science to some practical end. The foundation of the national research fellowships has put this country far ahead of what it was. Within the last twelve years our physics in the United States has leaped forward more than it had ever done in any previous decade.
>
> The first thing is to see that the spirit of science should be kept strong and active. The second is to spread the gospel of science throughout the country. Our work to succeed must be brought before the attention of the intelligent public in order that it might have a universal appeal. If it does not have a universal appeal, it will eventually fail.
>
> Dr. Millikan cited the Nobel prizes as an example of bringing the work of scientific research before the general public. *The Popular Science Monthly* awards, he declared, were in the same category with the Nobel prizes in that they will spread knowledge of what is being done in laboratories among the public and will add stimulus to research in pure science.

The committee of award consisted of:

Dr. Frank B. Jewett, vice-president, American Telephone and Telegraph Company, *chairman*.

Dr. C. G. Abbot, secretary, The Smithsonian Institution.

Dr. Samuel A. Brown, dean, New York University and Bellevue Hospital Medical College.

Dr. George K. Burgess, director, U. S. Bureau of Standards.

Dr. William W. Campbell, president emeritus, University of California; director emeritus, Lick Observatory.

Dr. Harvey N. Davis, president, Stevens Institute of Technology.

Dr. Arthur L. Day, director, Geophysical Laboratory, Carnegie Institution of Washington.

Dr. E. E. Free, consulting engineer.

Dr. Vernon Kellogg, permanent secretary, National Research Council.

Charles F. Kettering, president and general director, Research Laboratories, General Motors Corporation.

Dr. Arthur D. Little, president, Arthur D. Little, Inc., Chemists.

Dean Collins P. Bliss, director, Popular Science Institute, New York.

Dr. John C. Merriam, president, Carnegie Institution of Washington.

Dr. Robert A. Millikan, chairman, executive council, California Institute of Technology.

Professor Henry Fairfield Osborn, president, The American Museum of Natural History.

Dr. S. W. Stratton, Massachusetts Institute of Technology.

Dr. Elihu Thomson, director, General Electric Research Laboratories (Lynn, Massachusetts).

Dr. Edward R. Weidlein, director, Mellon Institute of Industrial Research.

Henry H. Westinghouse, director, Westinghouse Electric and Manufacturing Company.

Dr. Albert E. White, director, department of engineering research, University of Michigan.

Dr. Willis R. Whitney, vice-president and director of research, General Electric Company.

Orville Wright, scientist and inventor.

SCIENTIFIC NOTES AND NEWS

THE American Association for the Advancement of Science and about forty associated societies will meet at Cleveland during the week beginning December 29. The number of SCIENCE for November 28 was a special issue containing the preliminary announcement of the meeting edited by the permanent secretary. Dr. Thomas Hunt Morgan will preside at the opening session, when Dr. Robert A. Millikan will give the address of the retiring president on "Atomic Disintegration and Atomic Synthesis."

DR. ALBERT A. MICHELSON completed his seventy-eighth year on December 19, while engaged at Pasadena on the measurement of the velocity of light through a vacuum tube.

DR. JAMES H. BREASTED, of the University of Chicago, director of the Oriental Institute, has been

elected a corresponding member of the Institute of France. He succeeds to the place occupied by the late Sir Edward Maunde Thompson, for many years director of the British Museum.

DR. HEINRICH JACOB GOLDSCHMIDT, professor of chemistry at Göttingen, formerly of Oslo, has been elected a member of the Göttingen Academy of Sciences.

DR. PHILIPP FURTWÄNGLER, professor of mathematics at the University of Vienna, has been awarded the Ernst Albe memorial prize and medal of the Carl Zeiss Foundation.

THE gold Georg-Neumayer Medal of the Geographical Society of Berlin has been conferred on Dr. Hugo Eckener.

DR. CLAUDIUS REGAUD, director of the Radium Institute and professor at the Pasteur Institute of Paris, has been created commander of the Legion of Honor.

A JOHN C. HEMMETER professorship of physiology will be established at the University of Maryland School of Medicine, in honor of Dr. Hemmeter, who was graduated from the University of Maryland in 1884, and was appointed professor of physiology in 1891 and of clinical medicine in 1903. He resigned in 1922. Besides Dr. J. M. H. Rowland, dean of the school, the committee includes Dr. John Evans, secretary, and Drs. William J. Mayo, Julius Friedenwald, Randolph Winslow, J. M. T. Finney, Harry Adler, Robert P. Bay, William H. Smith, Thomas S. Cullen, H. A. B. Dunning, Arthur M. Shipley and Judge Walter I. Dawkins.

AT the annual meeting of the New York Academy of Sciences on December 15 the A. Cressy Morrison Prizes for 1930 were awarded to Professor H. von Zeipel, of the Astronomical Observatory at Upsala, for his paper entitled "The Evolution and Constitution of Stars"; to Dr. Ernst Gellhorn, of the University of Oregon, for his paper entitled "Permeability and Fatigue in Muscle and its Bearing on the Problem of Ion Antagonism," and to Dr. Douglas W. Johnson, professor of physiography at Columbia University, for his paper entitled "A Theory of Appalachian Evolution."

OFFICERS of the New York Academy of Sciences have been elected as follows: *President,* Clark Wissler; *Vice-presidents,* Horace N. Coryell, Horace W. Stunkard, Frederick W. Hodge; *Recording Secretary,* Roy Waldo Miner; *Corresponding Secretary,* Horace W. Stunkard; *Treasurer,* George H. Sherwood.

DR. CARL GUTHE, director of the Museum of Anthropology at the University of Michigan, was reelected president of the Michigan-Indiana Museum Association at the convention held recently at South Bend, Indiana.

DR. GEORGE D. LOUDERBACK, professor of geology, chairman of the department, and dean of the College of Letters and Sciences of the University of California, has been reelected president of the American Seismological Society. Dr. Perry Byerly, assistant professor of seismology and university seismologist, has been elected secretary.

DR. NEIL E. STEVENS, of the Bureau of Plant Industry, has been elected president of the Botanical Society of Washington.

DR. JUAN CARLOS NAVARRO, pediatrist, has been elected president of the Academy of Medicine of Buenos Aires.

AT the annual meeting of the Royal Society of Edinburgh Sir E. A. Sharpey-Schafer was elected president. The vice-presidents elected were Professor J. Graham Kerr, Professor W. Wright Smith, Professor F. G. Baily, Professor T. J. Jehu, Professor J. H. Ashworth and Dr. A. Logan Turner.

MR. W. L. GOSS, who has been connected with the Bureau of Plant Industry since 1905, has accepted an appointment with the California State Department of Agriculture. Mr. Goss will be in charge of the seed work for the state, including direction of the cooperative seed laboratory at Sacramento.

MR. CHARLES H. HADLEY, of the Bureau of Entomology, has been appointed to take charge of research on the Japanese beetle and Asiatic beetle at Moorestown, New Jersey. Mr. Hadley succeeds Loren B. Smith who resigned recently and comes to the bureau by transfer from the Plant Quarantine and Control Administration. Mr. L. H. Worthley, administrator in the field in the enforcement of the quarantine on account of the European corn borer, has taken over the field work of administering the Japanese beetle quarantine, of which Mr. Hadley has been in charge for two and a half years.

PROFESSOR VICTOR K. LAMER, of the department of chemistry, Columbia University, who is on sabbatical leave from the university where he has taught since 1919, will be visiting professor at Stanford University during the spring session of 1931. He will direct courses in physical chemistry and catalysis. Professor LaMer is a former chairman of the Organic Division of the American Chemical Society.

DR. EDMUND S. CONKLIN, professor of psychology in the University of Oregon, has been granted leave of absence for the winter term of the present academic year, and has accepted a visiting professorship in the University of Chicago for that period.

DR. E. LEG. TROUGHTON, of the Australian Museum, Sydney, is visiting the United States.

MR. C. P. CLAUSEN, of the Bureau of Entomology, who returned from Singapore to the United States late in September, left Washington on November 20 for Cuba, where he will observe the progress of the experimental work on the infestation of black flies with the parasites he brought over from the Malay Peninsula. Mr. Clausen will take some of the black flies from Cuba to Singapore, infest them with parasites, and send them back to Cuba.

DR. LAFAYETTE B. MENDEL, Sterling professor of physiological chemistry in Yale University, gave an illustrated lecture at Wellesley College on December 3, and before the Rhode Island Section of the American Chemical Association at Providence on December 11 on "Fat Formation in Relation to Diet."

DR. GEORGE E. NICHOLS, professor of botany at Yale University, delivered an illustrated lecture entitled "North American Arctic-Alpine Plants" at the Science Club of the Connecticut College for Women on December 12.

DR. M. H. SOULE, associate professor of bacteriology at the University of Michigan Medical School, gave an address on the first International Congress of Microbiology, held at the Pasteur Institute, Paris, from July 20 to 25, before the Biological Society of Purdue University on December 11. Dr. Soule was a member of the national committe of the congress.

ON November 24, 1930, Dr. Michel Weinberg, professor of bacteriology and chief of the laboratory service of the Pasteur Institute, Paris, gave an illustrated lecture before the faculty and students of the University of Colorado School of Medicine at Denver on "The Rôle of the Anaerobic Bacteria in Human Pathology." On November 25, Dr. Weinberg lectured before the Denver City and County Medical Society on "The Serotherapy of Medical and Surgical Infections Caused by Anaerobic Bacteria."

DR. W. STEWART DUKE-ELDER, of London, gave two lectures under the auspices of the Howe Laboratory of Ophthalmology on "Recent Work on the Metabolism of the Eye" at the Harvard Medical School on December 15 and 17. The first lecture was entitled "Physiological Aspects" and the second "Clinical Aspects."

RECENT speakers before the Geological Society of Northwestern University, with the titles of their addresses, are: Dr. G. R. Mansfield, U. S. Geological Survey, "New Discoveries in Geologic Structure"; Dr. David White, U. S. National Museum and Geological Survey, "Stratigraphic Problems of the Permo-Carboniferous"; Dr. Margaret Fuller Boos, U. S. National Park Service, "Geology of the Bryce Canyon Region"; Mr. Earl A. Trager, Skelly Oil Corp., "Subsurface Correlation in the Mid-Continent Field"; Dr. G. F. Loughlin, U. S. Geological Survey, "What is an Economic Geologist?"; Dr. Douglas W. Johnson, Columbia University, "Significance of the Low Shore Terraces"; Mr. King Hubbert, University of Chicago and Columbia University, "Isostasy."

THE North Jersey Section of the American Chemical Society will meet at the Hotel Winfield Scott, Elizabeth, New Jersey, at 7:45 p. m., on Monday, January 12. Dr. Saul Dushman will address the section on "The New Mechanics in Relation to Chemistry." An informal dinner at 6:30 p. m. will precede the meeting.

THE Committee on Scientific Research of the American Medical Association invites applications for grants of money to aid in research on problems bearing more or less directly on clinical medicine. Preference is given to requests for moderate amounts to meet specific needs. For application forms, please address the committee at 535 North Dearborn Street, Chicago, Illinois.

A NEW laboratory of the Rockefeller Institute for Medical Research is ready for occupancy this month. It stands on a high, stony bluff overlooking the East River and extends from 67th to 68th Streets. The building is seven stories in height with two basement levels, and has a cubage of about 1,500,000 feet. Connected with the laboratory is a wing of four stories for animals, which in turn connects through an additional new low animal unit of four stories with the main animal house which is six stories in height.

BUILDING will be started on the Benjamin Franklin Memorial and Franklin Institute Museum at Philadelphia in a few weeks, according to an announcement made by Mr. Cyrus H. K. Curtis, president of the Benjamin Franklin Memorial, Inc., who was host at a dinner given recently to 2,200 people who took part in the campaign to raise funds for the institution. John T. Windrim is preparing the plans. Subscriptions amounted to $5,060,809, in addition to $2,500,000 provided by the Franklin Institute for endowment. The central exhibition hall of the new building will be named the "Cyrus Herman Kotzschmar Curtis Hall" and the scientific library will be named in honor of former Senator George Wharton Pepper, chairman of the financial campaign.

A BEQUEST of $100,000 is made to Western Reserve University in the will of the late Dr. George Clark Russell.

A RHODODENDRON collection, said to be the finest in the United States, has been presented to the Univer-

sity of California by a group of donors. The collection contains 10,000 specimens, more than half of which are of especial interest. The collection was purchased from Messrs. Carl H. Andries and M. Jongeneel, who had propagated the plants at their nursery at Aptos, near Santa Cruz. Mr. Andries has been appointed superintendent of the Botanical Garden and rhododendron expert.

THE Mexican scientific society "Antonio Alzate" (founded in 1884) by virtue of a resolution passed by the President of the Republic and the Department of Public Instruction has been constituted as the National Academy of Sciences, under the title of Academia Nacional de Ciencias Antonio Alzate and was inaugurated on December 9. Its offices and library have been established in the new building that the Federal Government has granted to it at Justo Sierra Street, No. 19. The president of the academy is Alberto Maria Carreño, and the permanent secretary Rafael Aguilar y Santillan.

DR. EDWARD R. WEIDLEIN, director of the Mellon Institute of Industrial Research, has announced that the institution has lately begun a broad investigation into possible industrial uses for raw and refined sugar. The research will be carried on by a multiple industrial fellowship that will be sustained by The Sugar Institute, Inc., of New York, an organization that represents the cane sugar refiners of the United States. The comprehensive program of investigation will be supervised by Dr. George D. Beal, assistant director of the Mellon Institute, and by Dr. Gerald J. Cox, senior industrial fellow. They and the scientific investigators who will be under their direction in endeavoring to find and to develop uses for sugar in various industries will have the close advisory collaboration of Dr. Leonard H. Cretcher, the sugar specialist who is the head of the Department of Research in Pure Chemistry. According to Dr. Weidlein, various studies made by private research workers have already indicated results of industrial promise; these findings will be carefully studied in the laboratories of Mellon Institute. Most of these proposals relate to applications for sugar in such technologic practises as wood preservation, textile finishing, and the manufacture of adhesives. Sugar is thought to merit searching investigation as a basic raw material for employment in various branches of chemical industry. Four chemists, headed by Dr. Cox, have begun the initial scientific research of the industrial fellowship. Additions will be made to this staff, as needed, from time to time.

The Official Record of the U. S. Department of Agriculture reports that an investigation which, if successful, will lead to the commercial propagation of certain species of flies to be used by the medical profession in treating wounds and inflamed bones is under way in the Bureau of Entomology. This new treatment is the outgrowth of an accidental discovery by Dr. William S. Baer, clinical professor at the Johns Hopkins University. While serving at the front in the war, Dr. Baer was greatly interested in the remarkable healing of the wounds of two soldiers who had been brought in after lying for seven days on the battle field. The wounds were heavily infested with fly larvae. About eight years later Dr. Baer tried the larval treatment on a few of his patients who were suffering from osteomyelitis. Since then nearly 300 patients have been treated in this way. All the children and four out of five of the adults recovered, the cure usually being effected within six weeks. The success of Dr. Baer's experiments and the large number of cases to which this treatment is adapted have created a demand for larvae. The department entomologists are interested in accurate identification of the flies, in methods for their propagation in large numbers, and in methods of producing enough larvae in suitable condition for the surgeon.

IT has been decided that the British Photographic Research Association should go into voluntary liquidation. This decision, according to the London *Times*, has been reached in full accord between the Department of Scientific and Industrial Research and the manufacturer members of the association. Two main factors have necessitated this decision. The first is that important changes have taken place in the organization of the industry itself; manufacturing interests have been consolidated, and as a result the number of separate firms interested in the work of the association has been considerably reduced. The second factor is a very marked increase in the research work carried out in the laboratories of the manufacturing firms themselves. This widening of the outlook of the industry with regard to research is one of the results which it was hoped the research association would achieve. In a statement announcing the dissolution of the association acknowledgment is made of the valuable assistance and encouragement given by the Department of Scientific and Industrial Research, and grateful thanks are given to the director of research, Dr. T. Slater Price, who, assisted by a loyal staff, has throughout his period of office so ably and efficiently served the association.

THE registrar-general's statistical review for 1929, recently published, shows, according to a summary in the *Journal* of the American Medical Association, that the estimated population of Great Britain and Ireland was 48,684,000, compared with 48,574,000 in 1928, an increase of 110,000, or 0.23 per cent. Taking the constituent parts of the British Isles

separately, there was an increase in England and Wales and a decrease in Scotland and the Irish Free State. The estimated population of England and Wales in 1929 was 39,607,000, against 39,482,000 in 1928, an increase of 125,000, or 0.32 per cent. For Scotland the figures are 4,884,000 and 4,893,000, a decrease of 9,000, or 0.18 per cent.; for the Irish Free State 2,943,000 and 2,949,000, a decrease of 6,000, or 0.2 per cent. The marriage rate for England and Wales during 1928 was 15.8 per thousand living and was the highest since 1921. The number of divorces was 3,396 against 4,018 in 1928, a decrease of 15.5 per cent. The birth rate was 16.3 per thousand of population, against 16.7 in 1928, thus continuing the steady fall of recent years. The proportion of male to female births was 1,043 to 1,000, a close approximation to that in recent and prewar years.

DISCUSSION

AN INTERNATIONAL BOTANICAL ADDRESS BOOK

AT the final plenary meeting of the Fifth International Botanical Congress, Cambridge, England, August 23, 1930, it was unanimously resolved that an international address book of botanists should be prepared and published. A committee consisting of Professor L. Diels, director of the Botanic Gardens, Berlin-Dahlem, Dr. E. D. Merrill, director of the New York Botanical Garden, and Dr. T. F. Chipp, assistant director of the Royal Botanic Gardens, Kew, England, was appointed to consummate the project.

The last publication of its kind, Dorfler's "Botaniker Addressbuch," was published in 1909; the need of an up-to-date publication has been increasingly felt in late years, with the rapid growth of botanical science and the necessity for more general communication and cooperation among botanists in different parts of the world.

At meetings of the committee held in London on August 25 and September 4, 1930, it was agreed that:

(1) The address book should follow the general scheme of Dorfler, but the countries to be arranged alphabetically with a supplementary index by continents.

(2) The sections under each country should comprise a list of institutions and societies, and a list of botanists, with their surnames and initials, professional qualifications, offices, addresses and the special field of interest of each individual.

(3) Entries should be made in the language of each country in Roman characters.

(4) In applied subjects, such as forestry, agriculture and bacteriology, only those working in the botanical aspects of the subject should be included.

(5) The final compilation of data should be done at Kew.

It was tentatively decided that April 1, 1931, or a later date, if necessary, would be the date for closing the entries.

The committee realized that if the project was to be successfully consummated, the assistance of botanists in each country would be necessary. Accordingly, each member of the committee undertook the responsibility of collecting and collating the necessary data from the various parts of the world. Professor Diels accepted Central and Eastern Europe, U. S. S. R. and most of South America; Dr. Merrill, the whole of North America, the West Indies, other than the British colonies, Colombia, Ecuador, British, French and Dutch Guiana, Venezuela, Paraguay, all of Polynesia, and the Philippines, and Dr. Chipp the rest of the world.

Dorfler's address book had about 12,500 entries. It is estimated that a comprehensive new address book will contain in excess of 20,000 entries. To make it reasonably complete the cooperation of botanists everywhere is desired. If individuals within the areas assigned to me and who desire their names to appear in the new botanical address book will send me a post card giving the data required, I will see that these data are properly compiled and transmitted to the central office at Kew. What is needed in each case is the name and initials of the individual, his or her address, degrees and titles, position and special field of interest. About ninety collaborators have been selected and asked to compile data for specific areas, covering institutions and societies as well as individual names and addresses. Names of many individuals who should appear in the new address book will doubtless be overlooked, hence this appeal to individual botanists everywhere. Please compile the data required on an ordinary post card, in typewriting if possible, and send it to the undersigned; all such supplementary data will be collated with those supplied by the selected collaborators, before transmission to Dr. Chipp at Kew.

E. D. MERRILL

NEW YORK BOTANICAL GARDEN,
BRONX PARK, NEW YORK

THE WHALING SITUATION

DURING the past two years the writer has been interested in collecting statistical matter relative to present-day whaling. In a presentation of this subject in the January, 1930, number of the *Bulletin* of the New York Zoological Society, he introduced sta-

tistics showing the annual world catch as exceeding 20,000 whales. There were no returns then available of later date than 1928.

We are now in possession of statistics on whaling in all parts of the world for the season 1928–1929, showing a catch of 27,566 whales, yielding 1,867,848 barrels of oil. The composition of this catch was: blue whale 13,650, finback 9,132, sperm whale 1,761, sei whale 1,549, humpback 304, other whales 1,170. The species taken in greatest number is the blue whale, constituting nearly half of the total catch. To the above world catch may be added a few gray, beaked, bottle-nosed right and other whales now seldom found. The equipment employed in world whaling during the 1928–29 season was 25 shore stations, 30 floating factories and 237 killing boats attached to stations and factory steamers.

Norwegian whaling in all seas is far in the lead, with a catch of 14,996 whales. British whalers took 8,230 whales. The United States, once leader in the industry, does not figure, as the limited amount of whaling off our west coast and at Alaska shore stations is under Norwegian auspices, as is also that of British Columbia.

Mr. Takahashi, of the Marine Products Company of Tokyo, has supplied certain details respecting whaling in Japanese waters: The gray whale formerly rather common there is now rare, only six having been taken in 1928. Whales being used extensively for human food in Japan, the yield of oil for that country is not included in the above world total of products.

Other countries engaged in whaling in addition to those already mentioned are Denmark and Argentina, with a total of 1,770 whales. Shore whaling stations in South Africa and on islands in the Antarctic are operated by both Norwegian and British companies. At the present time whaling is conducted chiefly in Antarctic waters, where the annual catch of whales is on the increase. The whaling industry in northern waters is declining.

There has been an increase in the number of floating factories operating in the Antarctic, where the fleet is assembling for the Antarctic summer season. It seems probable that with increased equipment the total catch of whales for the 1930–1931 season will exceed that of any season so far recorded.

C. H. TOWNSEND

NEW YORK AQUARIUM,
DECEMBER 18, 1930

A SEQUOIA FOREST OF TERTIARY AGE ON ST. LAWRENCE ISLAND

THE recent discovery of the fossil foliage, cones and wood of Sequoia on St. Lawrence Island, in the Bering Sea, is of exceptional interest from the standpoint of the Tertiary distribution of this genus, and the geographic conditions under which it formerly lived.

Several references in the literature to the occurrence of fossil Sequoia on St. Lawrence Island have not been substantiated up to this time by actual specimens, so far as known to the writer. With the hope of securing material evidence of the occurrence, a request was made last May to Dr. Henry B. Collins, Jr., of the Smithsonian Institution, that he collect any fossil plants encountered during his ethnological investigations there. With the assistance of Captain Edward D. Jones, of the Coast Guard cutter *Northland,* Dr. Collins visited the locality near the west end of the island on August 14, and collected the specimens which are the basis of this record. Writing to me from Nome on August 20, Dr. Collins makes the following statement:

> I have just returned from St. Lawrence Island where I took occasion to look up the fossil plants mentioned in your letter of May 2. From the Eskimos I learned the location of the place they occurred (15 miles east of the N.W. end of the Island), and when the *Northland* came for me we stopped for a few hours and made a collection. Captain Jones was much interested, for which we may both be grateful, for it would have been difficult to reach the place except with the ship. Along a high bank bordering a lake, outcrops of coal were visible, and associated with these, slides of reddish slate in small blocks. These were very rich in fossil plants. Captain Jones is bringing you what I hope will be an adequate sample, almost one hundred pounds of the rock slabs.

When the *Northland* reached Oakland on November 23, Captain Jones turned over this collection to me. It comprises some twenty-five slabs bearing abundant impressions of the leafy twigs of *Sequoia langsdorfii,*[1] with a few Sequoia cones and the impressions of several broad-leafed species. There are also some specimens of fossil wood, all apparently of Sequoia, which indicate that the trees represented were of a size comparable to the living redwood, *Sequoia sempervirens.* The broad-leafed species include a species of poplar, probably *Populus richardsoni,* and what appear to be species of sycamore and alder. In addition to these slabs, all of which are a dense gray shale, Captain Jones brought me a small piece of light-colored volcanic tuff bearing impressions of Sequoia leaves, which was picked up elsewhere on the island by a native. It is lithologically similar to the matrix in which abundant fossil Sequoias have

[1] This species is not readily distinguished from the living redwood, *S. sempervirens,* but is considered as distinct because of its geologic antiquity.

been collected in the John Day Basin and elsewhere in western America. A future search for the source of this specimen may result in the discovery of many other species which are the common Tertiary associates of the Sequoia.

The occurrence of this genus on St. Lawrence Island during the Tertiary is highly significant in the light of its distribution elsewhere in the north Pacific region during that period. It is of wide extent in North America from California and Colorado north to Alaska, and is commonly associated in the fossil record with the Tertiary equivalents of most of the species now living in the Coast Redwood forest and in the Bigtree groves of the Sierra Nevada, in California. In Asia *Sequoia langsdorfii* and many of its American fossil associates are found in Manchuria and Siberia. St. Lawrence Island, at 63½° north latitude, lies approximately 40 miles from the nearest shore of Asia and 100 miles from the Seward Peninsula in North America.

A study of the distribution of the modern redwood along the California Coast indicates that its migration over a salt-water barrier is seldom if ever achieved. There are no known cases of the occurrence of redwoods on the islands adjacent to the main land occupied by the Redwood Belt. This is due partly to the fact that the redwood is largely restricted to valleys protected from the wind, where rich soil and constant climatic conditions are in marked contrast with those of the shore habitat. It is also due to the difficulty of cone distribution; the green cones are so heavy that they do not float; by the time they have dried out and become buoyant, the seeds have been shed. One of the common tests for viability of redwood seeds is to place them in water, the viable seeds sinking. While there is no reason to believe that redwood seeds would lose their viability through exposure to salt water for a few days, it is difficult to reconstruct conditions under which they would be floated either before or after being shed from the cones. The possibility must be considered that a trunk, with a cone-bearing branch attached, might have floated across the 40 miles of water from the mainland of Asia to St. Lawrence Island during the Tertiary, have seeded the island as a result of being dragged up into a valley suitable for the growth of redwood trees, and have made possible subsequently the journey of another cone-bearing log over the 100-mile stretch of water to North America; or that the journey may have been made in the reverse direction. On the basis of probabilities such a means of migration seems much less likely than that St. Lawrence Island represents the remnant of a land bridge which connected Asia with North America—a bridge over which the redwood forest was essentially continuous during at least the first half of the Tertiary, and across which not only land plants but land animals were able to migrate from one continent to another. The similarity of the life, both fossil and living, of the two continents lends much weight to this interpretation of the Tertiary Sequoia forest of St. Lawrence Island.

RALPH W. CHANEY
CARNEGIE INSTITUTION OF WASHINGTON
UNIVERSITY OF CALIFORNIA

THE DESCRIPTION AND FIGURING OF IMPERFECT FOSSILS

IN 1845 the Rev. P. B. Brodie published a work with many illustrations on the insects of the Mesozoic rocks of England. There were no formal descriptions of genera or species, but Brodie considered 32 of the species sufficiently well preserved to deserve names. In 1856, without seeing the specimens, Giebel provided names for 67 others, and much later Handlirsch proposed a number of genera and named 22 other Brodie figures. In one case a figure received a generic and specific name, and being inaccurately copied the copy got another generic and specific designation! The general result is that our catalogues of fossil insects are encumbered with numerous names which represent nothing which can be precisely identified. The example cited is only one of many coming down to modern times.

It is undoubtedly true that on occasion new knowledge or more critical judgment may justify the naming of a fossil first left nameless. But on the whole, if the original author does not care to give a name, the chances are that none is desirable. As it is impossible to prevent the naming of such figures or descriptions, it appears desirable to urge paleontologists to refrain from describing or figuring fossils they do not think deserve a name.

I had some correspondence with an eminent paleontologist on this subject and he was unable to support this conclusion. He urged, with reason, that it was often of importance to indicate the presence of a family or genus, though the species could not be determined. But it seems to me that in all such cases it would suffice to state the fact of occurrence without giving details or figures which could be made the basis of a new name.

T. D. A. COCKERELL
UNIVERSITY OF COLORADO

NAMES AND AMBIGUITY

OCCASIONALLY the technique of scientific writing may be improved by lessons from the technique of journalism.

Except in most exceptional circumstances, such as the progressing death list of a disaster, the modern newspaper insists upon the full name and initials of the news personalities whose doings or statements it reports.

In scientific articles, addresses, reviews and reports it is common practice to refer to scientific colleagues by their last name only. This is particularly the case abroad, especially in France. When scientists were few this practice may have been satisfactory, but, with the growing multiplicity of research and its numerous practitioners, a single last name citation is often ambiguous.

It is not yet necessary to follow the practice of the Library of Congress on its catalogue cards and give the date of birth as well as the full name, but even that practice in some cases would improve our historical horizon.

WATSON DAVIS

SCIENCE SERVICE

SPECIAL CORRESPONDENCE

COOPERATIVE GEOLOGIC RESEARCH NEAR RED LODGE, MONTANA

RESULTS of large scientific interest and possibly of very considerable practical importance have been yielded by the work of the geological investigators who operated during the past summer in the region near Red Lodge, Montana—that is to say, along the northeastern border of the Yellowstone Park or Beartooth plateau. Announcement has already been made of the discovery by Professor Edward Sampson, of Princeton, of the similarity in origin of the chromite deposits of the Beartooth area to those of South Africa—heretofore believed to be unique, and also of the finding near Red Lodge of dinosaur egg fragments by Dr. G. L. Jepsen and E. J. Moles, of the Princeton Scott Fund Expedition. These fossils are the first of their kind obtained in North America, and rendered doubly interesting because of recent paleontological prominence given to this region by the discovery of many primitive mammals by Dr. J. C. F. Siegfriedt. A tooth of one of these mammals was pictured and described in the *Literary Digest* as possibly belonging to the oldest known form in man's ancestral line.

An informal preliminary report on the party's study of the great fracture systems in the earth's crust limiting the eastern border of the Yellowstone-Beartooth plateau has been made by Dr. E. L. Perry, of Williams College, and Professor Erling Dorf, of Princeton, has also presented a similar statement regarding the very perfect fossil floras which had been located by Dr. Siegfriedt in beds just below those yielding mammal remains at the Eagle Coal Mine.

The problems of the physical geography and physiography of the region—already partially studied by Dr. Arthur Bevan (now state geologist of Virginia) and by Dr. W. C. Alden, of the U. S. Geological Survey—were further studied last summer by Professor Nevin M. Fenneman, head of the department of geology and geography of the University of Cincinnati and formerly chairman of the division of geology and geography of the National Research Council, and a report is being prepared by Professor Fenneman covering his findings. A detailed map of the river-terrace system around Red Lodge has also been prepared by J. H. Breasted, Jr., a Princeton undergraduate. Reports covering special phases of the chromite deposits are being worked on by E. B. Cartmell, of Yale, and by J. S. Vhay and J. W. Peoples, of Princeton, and the volcanic and intrusive rocks of an area near the Valley Ranch southwest of Cody, Wyoming, are also being studied by J. T. Rouse.

The splendidly exposed sections of marine Cambrian strata now exposed along the mountain uplift were examined during the summer by Dr. C. E. Resser, of the U. S. National Museum, and by Dr. Endo, of Manchuria—Dr. Resser's work being in continuation of his comprehensive studies of the Cambrian of the west which he began as assistant to Dr. Charles D. Walcott, late secretary of the Smithsonian Institution. Professor Dorf and Gordon K. Bell, Jr., of Columbia University, also made a reconnaissance study of the Cambrian, Ordovician and Devonian beds exposed in Beartooth Butte on top of the plateau, and 8,000 feet of Cretaceous-Eocene sandstone and shale beds exposed between the Dry Creek oil and gas field and the Bear Creek coal mines and fossil mammal locality were measured by W. C. Keith, Jr., and G. B. Hulett, of Princeton, as a basis for structural work and as a background for paleontologic interpretations.

Cooperative relations in support of effective, scientific research—both within and without the State of Montana—have been most gratifying and cordial. The Northern Pacific Railway has cooperated most helpfully. Governor J. T. Erickson, of Montana, tendered the assistance of his administration to the party; the officials of the state university, school of mines and Eastern Montana Normal School joined in

planning the work, and the Montana Association, the Billings Commercial Club and the research committee specially appointed by Red Lodge are aiding in arranging for future work. Through Dr. Francis A. Thomson, director of the Montana Bureau of Mines and Geology, the cooperation of the U. S. Geological Survey and the U. S. Army has been secured, respectively, for the topographic mapping and airplane photography of the region to be studied, and the U. S. Coast and Geodetic Survey has promised to extend its chain of gravity stations eastward from Yellowstone Park across this newly mapped area in order to ascertain how the geological and geophysical evidence indicative of the origin of mountain uplift may be harmonized.

Inquiries have been received from Wyoming sources as to the possibility of the work being extended southward into the Cody territory, and this possibility is under consideration at the present time.

W. T. THOM, JR.
RICHARD M. FIELD

PRINCETON UNIVERSITY

SCIENTIFIC BOOKS

A History of Science and its Relations with Philosophy and Religion. By WILLIAM CECIL DAMPIER DAMPIER-WHETHAM. Cambridge, at the University Press. xxii + 514 pp., 14 figs. in text. 1929. Price 18*s*.

To survey the universe from the electron and the cosmic ray to the gene and conditioned reflexes is an intellectual labor truly Herculean in its order of magnitude. But to trace, coordinate and place in their most significant relations man's ever-changing and his so recently greatly enlarged concepts of nature and the discoveries from which they have sprung is a task for which no ancient galaxy of gods has an appropriate prototype. It is Einsteinian in its proportions. The author of this "History of Science" has attempted this survey and analysis, chiefly, he tells us, for his own satisfaction and amusement, but certainly for the intellectual orientation of all who seek in the past an interpretation of this our own era of achievement and of change.

This is more than a history of the sciences or of science. Its central theme seems to be man's continuing efforts to understand and interpret nature and the interaction of his concepts thus derived with philosophy and religion

> Till out of chaos comes in sight
> Clear fragments of a Whole;
> Man learning Nature's ways aright,
> Obeying, can control.

To our historian science is more than natural science. It is the ordered knowledge of natural phenomena and also the rational study of the relations between the concepts in which those phenomena are expressed. Philosophy may protest the encroachment.

The work falls into ten chapters. The first four proceed chronologically through the science of the ancient world, the Middle Ages, the Renaissance and the Newtonian Epoch. Thenceforward the treatment separates the physical from the biological sciences, and segregates the interrelation of science and philosophy. Chapters V and IX treat of nineteenth century physics and the new era in physics, respectively. Chapters VI and VIII are concerned with nineteenth century biology and recent development in biology and anthropology. Chapters VII and X give the syntheses of nineteenth century science and philosophy and scientific philosophy and its outlook.

This is no place to construe the argument, much less to criticize the selection or the treatment of the material; both have the horizon and the *élan* to be expected from a scion of the illustrious explorer. The style is lucid, forceful and vigorous. The treatment is comprehensive, judicious and eminently free from bias. The aim is clearly synthetic throughout, and to this end the presentation of the separate scientific fields and of biographical aspects is quite subordinated.

Priority in formulation of an idea or in discovery does not seriously embarrass our historian. "In science 'being right is no excuse whatever for holding an opinion which has not been based on an adequate consideration of the facts involved in it.'"

Noteworthy in this survey is the selection and treatment of significant figures in the onward march of ideas: to alphabetize a few, Aquinas, Aristotle, Francis and Roger Bacon, Bateson, Bergson, Bishop Berkeley, Bernard, Berzelius, Bohr, Boltzmann, Boyle, Burt, Copernicus, Crookes, Darwin, Democritus, Eddington, Einstein, Foster, Galen, Galileo, Gauss, Haeckel, Helmholtz, Van't Hoff, Hume, Huxley, Huygens, Jeans, Kant, Kelvin, Kepler, Laplace, Lavoisier, Leibnitz, Leonardo da Vinci, Liebig, Lucretius, Lyell, Maxwell, Mendel, Mill, Millikan, Newton, Pasteur, Plato, Russell, B., Rutherford, Sarton, Singer, Thomson, J. J., Thomson, W., Voltaire, de Vries and Whitehead.

In a treatise of the scope of this work some deflections of emphasis and preference in selection result inevitably from propinquity and limitations in con-

tact. One has a feeling that the group is a little firmer in the physical than in the biological sciences. In the latter the outlook is quite Batesonian. The historical perspective might well have included L. Agassiz, and more emphasis given to the work of Franklin and Willard Gibbs. One looks in vain for Kircher, the reputed discoverer of bacteria. But one volume can not be an encyclopedia.

This "History of Science" is in sharp contrast with the work of professional historians who weave their interpretations out of the impermanent threads of war, politics or economics. It is an intellectual challenge, though by no means written as such, to all other interpretations of the past, and a most convincing and stimulating revelation of the foundations of this age of material and intellectual achievement.

It should be read and reread by those responsible for the formulation and conduct of all forward-looking educational policies in our universities. It may be illuminating to those advocates of culture who have regarded science as mere technique, and to pietists who fear its materialistic devastations.

CHARLES A. KOFOID

UNIVERSITY OF CALIFORNIA

Comets. By CHARLES P. OLIVIER. The Williams and Wilkins Company, Baltimore, 1930, pp. 246, illustrated. Price $3.50.

PROFESSOR OLIVIER wrote this book as a sequel to his "Meteors" with the purpose of supplying "a book of moderate size . . . useful to the astronomer who does not specialize in the subject, as well as to the average intelligent reader."

There is no doubt that the author succeeded in this. The book is well written and well printed. It fills a gap in modern astronomical literature, especially so as Chambers' "The Story of the Comets" is now somewhat obsolete.

The author selected several topics for his book. After chapters on the history of comets and general facts about comets follows a discussion of cometary groups, families, tails and spectra, chapters on several individual comets, connection of comets and meteors, collision of comets with the Earth and the origin of comets. In the last chapter the author gives his views on the origin of comets, and the appendix contains elementary notions from the theory of orbits.

The desire to avoid mathematics is probably responsible for the absence of a discussion of such important questions as the motion of matter in the heads and in the tails of comets, radiation pressure of the Sun and the luminosity of comets. However, no serious study of comets can avoid these topics, and the author frequently uses the terminology of the theory of comets without explaining it. The result is that in some few places the book will be hardly understandable even to an "intelligent reader." In the chapter on the "Spectra of Comets," for instance, such arbitrary notation as CNIV (cyanogen band λ3883), or the "third negative group of carbon" is mentioned without an explanation. Fluorescence and resonance phenomena are referred to, but the exact meaning of both is left for the reader to find out.

Some inaccuracies are unfortunately present in this book. On page 80 the wave-lengths of the Swan bands are given λλ5630, 5166, 4719 instead of the correct values λλ5635, 5165, 4737 for the brightest heads. The author does not explain that the angstrom is used here as the unit. On page 184 the wave-lengths of a band are given "from λ620 to λ700," again without mentioning that μμ is the unit. Indeed, no effort was apparently made to reduce all data to the same units. On many pages miles and kilometers are side by side. Some comets are denoted by Roman numerals according to the time of their perihelion passage; others by letters, according to the order of their discovery.

A misstatement occurs on page 184. The author says about Comet 1910a, "The several preliminary orbits published differed widely from one another. As an example the first three gave the inclination 62°, 85° and 57°, respectively. A correct orbit finally gave it as 139°, entirely reversing even the direction of motion! . . . No decided deviation from a parabola could be found." The reader might possibly infer that something went wrong with the computations, or that the comet was not observed accurately enough. However, this was the classical case of a triple solution, and the definitive orbit by Simas gave an indication of ellipticity.

On page 42, referring apparently to one of the famous "Schmidt's Clouds" in Comet 1882 II, the author says, "Its orbit proved to be quite similar to that of the main comet." On the contrary, Bredichin and others showed that the clouds moved under appreciable repulsive force of the Sun. The comet itself is denoted by the author as 1882 III, instead of 1882 II.

In the appendix the author gives *seven* elements for an ellipse, the semi-major axis and period are listed separately. The latter is denoted for no apparent reason as *Pe.*

From a statement on page 192 the author appears to be unaware that the question of the common origin of comets and asteroids was seriously discussed as early as 1851 by Stephen Alexander.

The typographic work is good, although a few misprints have been noticed. It is unfortunate that

in references the volume is not indicated by the boldface type as is customary.

The above-mentioned defects are not of a serious kind and can be corrected in the second edition. As it stands, the book will be very useful in awakening interest in comets among amateurs and as a reference book for professional astronomers.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

FIBER TAGS FOR WET SPECIMENS

TAGS bearing catalogue numbers or other entries for the identification of single specimens are an indispensable item in various museum and laboratory collections of objects preserved in fluid. It is obvious that such makeshifts as paper and tape labels are to be avoided, since the first requisite of a tag is permanence. The tag should be made of a durable material which withstands handling and resists disintegration in preserving fluids; the entry which it bears must be permanently clearly legible, and the attachment to the specimen must be secure.

A variety of permanent tags have been devised. Strips of sheet tin, stamped with number dies, may be seen in some zoological collections; these occasionally corrode in preserving fluids. Payne[1] seals a small paper label within a piece of glass tubing, bent into a loop at one end for insertion of the thread for tying. Robertson[2] and Pollock[3] present accounts of the employment of fiber tags in the storage of pathological specimens, at the University of Minnesota and the Mayo Clinic, respectively. Dr. Maude Abbott, in a personal communication, commends the fiber tags, stating that they have been used for some years in the Medical Museum at McGill University. Several years ago the writer, then unaware that the material had been so employed, chanced upon fiber composition for the manufacture of tags. Inquiries indicate that such tags are not generally known, and this note is presented with the aim to emphasize their desirable features. Fiber tags have been used in our laboratory over a period of several years for anatomical specimens preserved in formalin, alcohol, Kaiserling and Bouin's fluid.

Sheets of "vulcanized fiber composition" of different thicknesses and in three colors (red, black and white) are obtainable from dealers in electrical supplies. I have been using the 1/16 inch thickness (red), though a thinner stock may be as serviceable and is perhaps even more suited to tags of small size. The material is sold by weight. A sheet measuring 3 x 3 feet, 1/16 inch thick, retails for about $2.50. The sheet is cut readily with a paper cutter or heavy shears into tags of the desired dimensions (in this laboratory, about $\frac{1}{2} \times 1\frac{1}{4}$ inches). The tags are punched at one end for tying, and stamped with dies (in this laboratory, numbers $\frac{1}{4}$ inch high) to register the accession number of the specimen. Deep, clean-cut impressions are insured if the tag rests on a block of iron during stamping.

After some hours of immersion in fluid the tag undergoes a just appreciable swelling and becomes slightly limber. Excepting this initial change no alteration can be detected.

The features of the fiber tag may be summarized as follows: (1) permanence and practicability, evidenced by actual service in at least four institutions; (2) simplicity of manufacture; (3) low cost.

HAROLD CUMMINS

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SPECIAL ARTICLES

WESTERN DUCK SICKNESS PRODUCED EXPERIMENTALLY

FOR the past two decades mortality among waterfowl in western states has attracted the serious attention of conservationists. During certain of these years losses among ducks and shore birds have been so great at some points as to make the annual toll taken by hunters appear insignificant. In 1910 untold thousands of waterfowl perished in the marshes about Great Salt Lake, Utah, and the years immediately following saw a recurrence of the sickness but, fortunately, in reduced severity. Yet even under these improved conditions it was necessary to bury the bodies of nearly 50,000 ducks at the mouth of Bear River, Utah, in the period from September 7 to 26, 1913.[1]

In 1914 the Bureau of Biological Survey undertook a study of the malady, assigning Dr. Alexander Wetmore to the task. The summer and fall seasons of 1914, 1915 and 1916 were devoted to the work and the results published in two papers, a preliminary report[2] in 1915 and a final bulletin in 1918[1] (refer-

[1] J. F. Payne, "A Permanent Tag for Museum Specimens," Intern. Assoc. Med. Mus., *Bull.* 8, 1922.

[2] H. E. Robertson, "Difficulties Encountered in the Condensation of Museum Material," *ibid.*

[3] M. Pollock, "Methods for Concentration of Museum Specimens," *ibid.*, *Bull.* 10, 1924.

[1] Alexander Wetmore, "The Duck Sickness in Utah." U. S. Dept. Agri. Bul. 672, pp. 1–26, pls. 4, 1918.

[2] Alexander Wetmore, "Mortality among Waterfowl around Great Salt Lake, Utah," U. S. Dept. Agri. Bul. 217, pp. 1–10, pls. 3, 1915.

ence above). The conclusion reached at that time indicated that the duck sickness in Utah was caused by the toxic action of certain soluble salts found in alkali and pointed to the chlorides of magnesium and calcium as two of the causative agents.

Since 1918 records of the occurrence of duck sickness have shown it to be a wide-spread yet localized malady. Roughly, the range of the disease in the United States conforms to the region of alkaline waters, yet its prevalence by no means coincides with the degree of concentration of alkali. Certain lakes of rather high alkalinity have been found to harbor waterfowl in numbers year after year with no ill effects on the birds, while other waters and marshes of nearly fresh water have experienced outbreaks of great severity precipitated apparently by such factors as low-water level and high temperatures. Under such conditions the attendant phenomenon of profuse decay of vegetable and animal matter often has been reported.

It was, therefore, with the idea of learning whether factors other than alkali might enter into the problem, particularly at points away from the influence of the highly saline conditions at Great Salt Lake, that the Biological Survey resumed its study of this malady. The area chosen was the region of Upper and Lower Klamath Lakes, Oregon, and Tule Lake, California. Preliminary work was started in 1927 when Mr. C. C. Sperry made observations and conducted experiments during August and September. No work was done in 1928, but for the past two seasons the writer has been engaged in this work.

Experiments were conducted along the usual lines of approach. There was feeding of natural and synthetic alkali both by the capsule method and through the medium of drinking water. There were attempts to transmit the disease by the feeding of body tissues of sick birds, and by inoculation in various manners commonly employed in conveying bacterial diseases. The conditions of vegetable and animal decay prevalent in duck sickness areas suggested other experiments and attempts also were made to demonstrate the possibility of certain anaerobic bacteria as a basis of the ailment. All these failed to give anything tangible or consistent in results. Birds were killed in the course of some of the experiments and now and then an isolated or fleeting symptom of duck sickness appeared, but nothing approaching the typical malady was produced or transmitted. Subsequent chemical analyses of waters and muds from sickness and non-sickness areas likewise failed to shed any light on the subject and until the middle of the present summer the whole problem seemed to be in more of a maze than ever.

About that time, however, a clew, revealed by the fortuitous circumstance that I was inadequately prepared to preserve under refrigeration certain body tissues of sick birds that were being fed to gulls in an attempt to transmit the disease, led to a series of experiments giving results wholly unexpected in the light of earlier investigations of duck sickness. Without going into detail at this time, the principal findings may be stated in the following language:

(1) Duck sickness symptoms, including the paralysis or weakness of the wing, leg and neck muscles, the paralysis of the nictitating membrane, discharges from the eyes and nostrils, difficulty in breathing, a lowered body temperature, and green diarrhea, all have been accurately and repeatedly reproduced by the feeding of the incubated body tissues of birds that have died of duck sickness after this material has been kept at a temperature of 85° Fahrenheit for 5 or more days.

(2) Allowing for variations due to the factor of individual susceptibility, the rapidity and severity of the onslaught of symptoms appears to be directly proportional to the quantity of material fed. With mallards and pintails, single doses of from 1/20 to 1/10 gram have permitted the birds to recover within four to six days in some of the cases, while doses as great as 1/2 gram to 1 gram usually have proved fatal within 12 to 24 hours.

(3) The virulence of this toxic material appears greatest when derived from birds that are the same, or are closely related to, the species being treated. Much still remains to be learned by experimentation in this direction, but up to the present time the writer has been unable to produce duck sickness symptoms in gulls by feeding material derived from any species of duck, and, in like manner, material from pintails appears more toxic to individuals of that species than to mallards.

(4) Even under the limitations of a field laboratory, it has been noted that certain batches of "incubated" tissues of birds dying of duck sickness do not become toxic. In such cases the difference in condition often is visible to the unaided eye, as, for instance, when liquefying bacteria become dominant and decomposition follows along a line quite different from that which gives toxic results.

(5) Although most of the results were obtained from incubated liver, later experiments indicate that material other than the liver may serve as a source of toxic material. Incubated blood taken from the carotid artery gave positive results in a recent experiment, and decomposed kidneys likewise have produced duck sickness symptoms.

(6) As a check against these experiments the nontoxic character of decayed liver of healthy ducks as well as of certain of the lots prepared from sick

birds (see paragraph No. 4) has been shown by experiment.

(7) The percentage of mortality among the birds made sick experimentally has been much greater than what occurs in the field. This is due partly to the excessive doses administered in early work; and partly to the fact that the great majority of sick birds brought in from the field for observation are sublethal cases. Birds given reduced doses, however, recover in the same manner and in about the same time as do those collected in the field.

(8) The faithfulness and consistency with which duck sickness symptoms are produced by this method has never been even remotely approached in any experimental work that the writer has done through the feeding of natural or synthetic alkalies.

(9) Not only have duck sickness symptoms been conveyed from the body tissues of a bird sick in the field to a healthy experimental bird by the method described, but this second bird has furnished toxic material for a third; the third in turn, for a fourth; and the fourth for a fifth. There seems to be no loss in virulence and, in fact, if any change has taken place, potency has been increased by this process.

(10) An extract of the toxic liver in normal salt solution prepared at the rate of 1 gram of decomposed liver to 5 cc of the solution, which is then filtered or allowed to settle, has permitted the injection of the toxic material into the abdominal cavity with equally typical and even more effective results. By this method material obtained from ducks has produced duck sickness symptoms in gulls, and, strange though it may seem, an extract of the incubated liver of a juvenile prairie falcon served as a means for conveying the trouble in an aberrant and mild form to a chicken and a domestic cat.

(11) Material obtained from the Bear River Marshes at Great Salt Lake has given results identical in every respect with that collected in the Klamath region.

(12) On the basis of a single experiment, it appears that boiling heat for about five minutes at this altitude (4,137 ft.) destroys the toxicity of the material.

(13) Contraction of duck sickness in the field does not establish an immunity to the symptoms as produced by this method, since birds that have recovered from duck sickness have been used two and three times in these experiments with positive results.

(14) An individual experiment performed by Mr. Sperry in 1927 in which he produced what appeared to be duck sickness symptoms by feeding liver to a duck over a period of nearly three weeks becomes explainable through the likelihood that, at some point in the feeding operations, the tissues on hand had "incubated" sufficiently in a period of hot weather.

In the foregoing the writer, an ornithologist, whom circumstances have thrust into the midst of a most baffling pathological problem, has aimed to present only such facts as have been learned from experimentation. Prudence forbids speculating at this time beyond what has actually been demonstrated, even though the results attained are highly suggestive and even though definite theories have been entertained as a help in directing the study. What has been accomplished appears to be just a beginning with much work yet to be done by specialists. Material has been gathered for histological, pathological and bacteriological studies which, as they are pursued during the coming months, may add even more startling chapters to an already intriguing subject.

E. R. Kalmbach

Biological Survey,
U. S. Department of Agriculture

WESTERN DUCK SICKNESS AND BOTULISM

The symptoms observed in ducks suffering from what is called "duck sickness" are characteristic of botulism as it appears in birds. Several samples of mud and water from an infected area in Tule Lake, California, were collected by one of us with the assistance of Mr. E. R. Kalmbach of the Biological Survey, during the summer of 1930, and while the outbreak of duck sickness was at its height. Bacteriological examination of the mud disclosed the presence of *Clostridium botulinum,* Type C. The primary cultures of the mud produced a toxin of rather high potency for guinea pigs (m.l.d. less than 0.001 cc for a 250 g pig); per os the m.l.d. was 0.05 cc. The m.l.d. for a domestic mallard (per os) was found to be 0.005 cc per gram of body weight.

Furthermore, *C. botulinum,* Type C, has been cultured from the tissues of wild mallards, pintails and ring-billed gulls that had died of or were killed while afflicted with "duck sickness." The clinical picture coupled with the isolation of botulinus organisms from the mud of Tule Lake and the sick birds themselves suggests that duck sickness is produced by the toxin of *Clostridium botulinum,* Type C.

L. T. Giltner,
J. F. Couch

Bureau of Animal Industry,
U. S. Department of Agriculture

BOOKS RECEIVED

Contributions from the Department of Anatomy of the Peking Union Medical College, Peking, Volume 5, Collected Papers Nos. 84–114.

Harding, T. Swann. *Fads, Frauds and Physicians.* Pp. 409. Dial Press. $3.50.

Wheeler, William M. *Demons of the Dust.* Pp. xviii + 378. 50 plates. Norton. $5.00.

SCIENCE NEWS

Science Service, Washington, D. C.

ATOMIC ENERGY

TEMPERATURES of forty million degrees Centigrade (about 70,000,000 degrees Fahrenheit) will be required before man can release the energy of the atom, a release that is continually occurring in the stars and keeping them going. So members of the World Power Conference meeting in Berlin were told by Sir Arthur Eddington, astronomer at the University of Cambridge.

Every star is a celestial furnace, declared Sir Arthur. It is fed by subatomic energy. He expressed the belief that the source of this energy is the continual building up of complex elements out of hydrogen, the simplest of the elements. According to his theory, there is a process going on deep within the stars by which the primitive electric charges are evolving into atoms. Another possibility for the source of stellar energy, he admitted, is the annihilation of the electrons and protons of which atoms are made. As one is negative electricity and the other positive, the union of an electron and a proton would eliminate each and result in a burst of light or other electromagnetic radiation.

An approach to the far distant time when the atomic energy can be released by man by the use of the forty million degree temperature has been made by Dr. Kapitza, of the Cavendish Laboratory at Cambridge. Sir Arthur told of his colleague's experiments with extremely intense, though momentary, magnetic fields, the highest corresponding to a million degrees of heat.

A possible way in which subatomic energy may be released without such high temperatures may be found in the process causing the penetrating radiation studied by Kohlhörster in Germany and Professor R. A. Millikan in America. According to Professor Millikan's views these rays are caused by the building up of atoms in interstellar space.

In any event, said Sir Arthur, the universe will eventually reach a state of stability, of "uniform changelessness."

GENERATORS OPERATING IN HYDROGEN

WHEN engineers have made the largest electric generators possible, they will be able to still further increase the capacities of the huge machines another 25 per cent. by running them in an atmosphere of hydrogen gas. The light, inflammable gas has already been used successfully with a small enclosed generator, M. A. Savage, of the General Electric Co., told the World Power Conference meeting in Berlin. Engineers have learned from its operation how to apply hydrogen to the largest units.

"These data indicate that large generators can be built with efficiencies at rated load six tenths of one per cent. higher when operating in hydrogen and that the active magnetic material can be reduced some 25 per cent. for the same kilowatt output. Expressing this in another way, machines of 25 per cent. greater output will ultimately be possible when the limit in capacity is reached in air-cooled generators. Hydrogen cooling is a perfectly practical thing and its adoption will mark the next big step in the increase in efficiency of these large units."

Although an increase in efficiency of only six tenths of one per cent. seems very insignificant, if applied to the world's largest generator it would mean an additional capacity of more than 1,200 horsepower. The capacity of this one unit exceeds 200,000 horsepower and operates at an efficiency of about 98.5 per cent.

Hydrogen is more desirable than air as an atmosphere for generators because it reduces one of the machine's greatest losses, that caused by wind resistance. Hydrogen has only one fourteenth the density of air. Just as it is easier for a cook to stir water than a thick cake batter, so the rotor of a generator turns more readily in hydrogen than in air.

Generators using hydrogen will be entirely enclosed and the gas will be under a pressure slightly higher than atmospheric. It will then slowly leak out around the rotating shaft and there will be no danger of an explosive mixture accumulating in the enclosure.

ELECTRICITY ON THE FARM

NOT content merely to substitute for mechanical power and man-power on the farm, electricity is finding new and exclusive ways in which it can bring to agriculture advantages of research corresponding to those enjoyed by industry.

Electric lubrication of the soil to make plowing easier, electric treatment of ensilage so that it will keep better, the heating of hotbed soil with electricity, and putting crops under electric discharges and under ultra-violet and white light to increase yield are subjects of recent research, C. A. Cameron Brown, of the British Institution of Electrical Engineers, has reported to the World Power Conference.

Similar research is being carried on in different countries and some workers report more success than others with the same project. The cheapness of electrical energy is apparently the greatest factor determining the success of the new methods.

Water already in the soil is the lubricant for plowing. It is drawn to the mould-board of the plow by making that the negative terminal of an electric circuit. The coulter, insulated from the framework, is the positive terminal. Field experiments show that the force required to pull the plow is reduced every time the current is turned on. Dr. B. A. Keen, of Rothamsted, England, says that the method has definitely passed the experimental stage and is awaiting commercial exploitation.

The ensilage treatment has reached its greatest development in Germany. Metal plates at the top and bottom of a silo are used for terminals and a current is passed through the feed which heats it and destroys organic life. Feed can be harvested in any weather

without being cured in the field, according to reports, and when given the electrical treatment will last longer and retain a much larger percentage of its original food value. Manure is replaced by electrical heating units in the hotbed application. Countries with abundant electricity from waterpower are said to have found this method successful.

Light has probably found its greatest use for increasing farm productivity in the poultry house. Making hens work overtime during the dark hours of late winter mornings and early evenings to even out the egg production curve has become common practice with many progressive poultrymen. The application of light and electrical discharge to plant production is in a more preliminary stage.

THE PITUITARY GLAND AND HARDENING OF ARTERIES

THE probable rôle played by the pituitary gland in the development of arteriosclerosis, more familiarly known as hardening of the arteries, was discussed by Dr. Robert C. Moehlig at the meeting in Detroit of the Association for the Study of Internal Secretions.

The effect of feeding animals on high fat diets, on normal diets with injections of the posterior lobe of the pituitary gland, and on high fat diets with the pituitary injections were reported. Control animals were fed on normal diets alone and compared with the other groups.

Four of the five animals fed on the high fat diet alone showed gross arteriosclerotic changes of the aorta, the main blood vessel from which the arteries of the body proceed. Those fed on the high fat diet plus the pituitary extract showed the most intense lesions of all. Eight of the ten animals showed marked arteriosclerotic changes and microscopic examinations disclosed changes of the type seen in human hardening of the arteries.

The injection of the pituitary extract alone, without any dietary influence, produced overdevelopment of the cortex of the adrenal glands. Dr. Moehlig called this an important link in the chain of arteriosclerosis.

At the same meeting, Dr. W. Raab, of Prague and Vienna, described experiments of his which showed the rôle played by the pituitary gland in regulation of the body's fat. Dr. Raab concluded that injection of pituitary extract favors the absorption of fat by the liver. Assuming that a certain amount of fat is normally destroyed in the liver, it is evident that if the pituitary is disturbed in its cooperative activity with the brain and nervous system, these fat amounts will not be destroyed. They will be stored in the tissues and consequently lead to obesity.

THE CAUSE OF EYESTRAIN

EYESTRAIN, so-called, is more apt to be the result of "nerves" than of any disease of the eyes, Dr. George S. Derby, of Boston, told members of the American Medical Association at their meeting recently. Dr. Derby described a number of cases he had seen in which the patient recovered from his eyestrain when his bodily condition was treated and when the psychologic cause of his eyestrain was explained and he was persuaded to use his eyes normally. Dr. Derby suggested that the term eyestrain should be banished from our vocabulary.

"If the general public could learn that eyes are seldom strained, this would be a much happier world to live in," he said. "The fact of the matter is that the eye is provided with a large factor of safety and that healthy eyes do not become diseased even by excessive use."

Most of these cases of ocular neurosis, as Dr. Derby called it, are found in sensitive nervous persons. Fear is the commonest factor in these cases. Some ocular pain or discomfort makes the patient afraid that he is injuring his eyes permanently, that he can not continue his occupation and perhaps will become dependent. Many of Dr. Derby's patients had given up their work and many pleasures, and were devoting themselves to resting their eyes as much as possible.

Dr. Derby asked ophthalmologists not to overlook the psychologic factor in causes of eyestrain, and to treat the mental condition of their patients as well as to correct their vision with eyeglasses.

THE BEAM MICROPHONE

AN artificial "whispering gallery" is one of the latest improvements in talking movies, for the device makes it possible to focus the microphone on the speakers and shut out extraneous sounds. Recording engineers of the RKO Productions at Hollywood have developed the device, which is called the "beam microphone," and have been using it in a new production "The Record Run," now nearing completion.

The device is really a searchlight turned backwards and using sound instead of light. A searchlight reflector has the shape known as a paraboloid. Light radiating from a point known as the focus is reflected in a parallel beam. The reflector also works backwards. If a parallel beam of light, as from a very distant object, falls squarely on the reflector, the light is concentrated at the focus. Searchlight mirrors have actually been used this way with sunlight to obtain high temperatures for experimental purposes. A reflecting telescope used by astronomers works the same way.

Waves of sound can also be concentrated by a parabolic reflector, and this is the principle of the beam microphone. A metal reflector about five feet in diameter is used, with the usual condenser microphone placed in the center at the focus. Around the outer edge is a cylinder of felt to shut out most of the sound that would come across the edge of the reflector.

In use, the beam microphone is mounted in trunnions on a stand similar to those used for the large lights for illuminating the studio. It can be aimed at the actors, whose voices are picked up and intensified, while other sounds, if not too loud, are largely eliminated.

Though the device has proved especially valuable for out-of-door recording, where it is not always easy to prevent other noises in the neighborhood, it is also being used to advantage within the soundproof studios. For

instance, the RKO studios are now producing some pictures in wide film as well as the normal 35 millimeter version. The wide-film cameras are much noisier than the ordinary ones, and more difficult to silence with a soundproof cover, or "blimp." The beam microphone aids in keeping their grinding from being recorded with the voices of the actors.

Famous whispering galleries in buildings throughout the world depend on a similar principle of sound concentration. Some architectural freak may produce a curved wall that focuses the sound from a distant point. Then a person may hear a whisper from a position hundreds of feet away, but can not hear ordinary conversation much closer.

In the Louvre, in Paris, there is a famous whispering gallery caused by two huge alabaster bowls at opposite ends of a long chamber. A person standing before one bowl can hear a whisper made by a person at the far side of the other one. The bowl acts as a reflector, sends the sound waves in a beam to the curved ceiling, whence they are reflected to the other bowl, which then, like the microphone reflector, focuses the sound so the second person can hear it.

ITEMS

DEFINITE steps have been taken for the establishment of a botanical experimental area on the slopes of the lofty extinct volcano Mauna Kea, where all the widely varied climatic conditions of Hawaii are available, with a view to establishing a world center for botanical research. Plants will include those from nearly every country bordering the Pacific area, including New Zealand, Fiji, New Hebrides, Samoa and the Solomon Islands.

AN out-of-door laboratory for the testing of high voltage transmission line equipment is to be erected at Pittsfield, Massachusetts, by the General Electric Company. When nature does not produce in it the kind of weather wanted for testing the apparatus, an artificial rain-maker will be brought into use. This new experimental room is to be entirely separate from the artificial lighting laboratory where flashes up to 5,000,000 volts have been created.

EXHIBITS showing how the Army, the Navy and the general public in the United States are kept in good health are to be sent to Germany at once for an exhibition on international hygiene. A bill appropriating money to prepare and transport the exhibits has just been passed by both houses of the Congress, and the Surgeons-General of the Army, Navy and Public Health Service will have the work done at once. The exhibition started at Dresden last month, but it continues in session until October.

HARVESTING timber while it is still young and healthy is a means advocated by Professor Ernest E. Hubert, of the University of Idaho, as a way to avoid the enormous losses caused by fungous and other diseases of trees. Damage from this source amounts yearly to six billion cubic feet of timber, valued at about $878,000,000. Forest trees, like human beings, are most liable to disease in middle life and at advanced ages, and if they are put to use before they develop the manifold ills that wood is heir to they will give the saplings growing about them a chance to reach merchantable size with sound heartwood.

A YOUNG male gorilla grows more slowly than a boy of the same age. So reports Dr. C. V. Noback, of the New York Entomological Society, who has made a detailed study of a youthful gorilla received in New York some time ago. The rate of growth during the first three years of life was measured in terms of adult weight. Possibly correlated with this slower growth is the fact that the bones and teeth of the gorilla mature more rapidly than those of a human child. The animal reported in Dr. Noback's study had its full set of milk teeth at approximately eighteen months, and began to acquire permanent teeth at two and one half years. The study will be reported in full in an early issue of the *American Journal of Physical Anthropology*.

A CENTURY after the falls and rapids of Niagara were first overcome for water transportation by a small canal, there is nearing completion on practically the same site a mammoth structure which will pass giant 600-foot lake grain vessels up and down the 326.5-foot difference in elevation between Lake Erie and Lake Ontario in a few hours' time. The lift of the Panama Canal is only 85 feet. The Welland Canal's 326.5-foot lift is possibly the greatest of major canals and is especially noteworthy because a sharp rise in elevation makes necessary its accomplishment in a very short distance. The total length of the canal is 25 miles. The present canal is the result of the fourth reconstruction and cost about $115,000,000. The first was completed in 1829 and had 40 wooden locks, 110 feet long, 22 feet wide and 8 feet deep. In the modern structure only seven locks raise vessels 46.5 feet at a time.

IF your parents lived a long time, you have a better chance of reaching a ripe old age than your fellow men, Dr. Louis I. Dublin, statistician of the Metropolitan Life Insurance Co., reported at the meeting of the Eugenics Research Association. Heredity as well as environment affects the length of a man's life. The longevity records of over 70,000 white men were followed in Dr. Dublin's study from the date of their insurance at the beginning of the century to 1928. The men were divided into two groups: those whose parents died before 50 years and those whose parents were living after 50. There were fewer deaths in the second group than in the first. Members of the second group moreover could expect to live on the average two and a half years longer than members of the first group. These results were confirmed by studies made of records of 34 American and Canadian life insurance companies between the years 1869 and 1900.

SCIENCE NEWS

THE GERM OF MULTIPLE SCLEROSIS

MEN and women of science working patiently together in the small, obscure neurological laboratory of the Westminster Hospital in London, England, claim to have discovered the smallest disease germ ever seen by the human eye. In doing so they believe they have paved the way to the conquest of some of the most mysterious and terrible diseases afflicting mankind.

The organism they declare they have isolated, identified and photographed is thought to be that of multiple sclerosis—commonly called "creeping paralysis"—once a rare disease in this country, but now not at all uncommon.

The germ is one of a group known as the filterable viruses, which are so minute they will pass through a porcelain filter, which catches all hitherto discovered organisms. Hitherto, these have remained invisible even under the most powerful microscopes. They include the forms of parasitic life causing infantile paralysis, encephalitis (sleeping sickness), measles, smallpox and some of the most deadly diseases of animals, such as distemper among dogs and pleuro-pneumonia among cattle.

This information is vouched for by Dr. Foster Kennedy, professor of neurology at the Cornell University Medical School and attending physician in charge of nervous diseases at Bellevue Hospital, New York City. He returned from abroad a few days ago after carefully reviewing the work done in the Westminster Hospital laboratory.

Dr. Kennedy reported that under the enormous magnification of 1,800 diameters glistening globules which seem to have life now can be seen and photographed. These are definitely claimed by Sir James Purves Stewart, neurologist of the Westminster Hospital, and Miss Kathleen Chevassut, the highly skilled technician who has actually conducted the experiments, to be the organism responsible for "creeping paralysis."

"While it is seldom wise to make positive predictions," Dr. Kennedy said, "it is quite possible that this work will lead to the discovery of the organisms causing measles, infantile paralysis, sleeping sickness, distemper among dogs and pleuro-pneumonia among cattle."

He recalled that in 1925 Mr. Barnard, who had cooperated with Dr. William E. Gye, of London, announced that his ultra-microscope had revealed the organism of chicken cancer. At that time Dr. Max Cutler, of the Memorial Hospital in New York, associated with the Cornell Medical School, was sent to England to check up the work of Barnard and Gye. His report did not confirm their announcements.

But this time, so important does Dr. Kennedy consider the results attained, an ultra-microscope has been ordered from Mr. Barnard, and Dr. Lewis Stevenson, neuropathologist, has been sent over to work in the Westminster Hospital laboratory until he has mastered the technique of Miss Chevassut and can reproduce her experiments. He will then return and attempt to repeat them in the new neurological laboratory of Bellevue Hospital.

"If this can be done," said Dr. Kennedy, "we shall feel reasonably sure that the organism causing multiple sclerosis has been discovered, and that we may be on the way to developing a serum with which to treat the disease. At present, I can only say that the work thus far is very hopeful. The experiments have been conducted with the utmost care, but until the same results can be obtained under entirely different surroundings—not simply in other London laboratories—we must consider the work as tentative only."

Aside from the development of Barnard's ultra-microscope, the detail of technique which seems chiefly to be responsible for the discovery is the making of cultures in a completely sterile atmosphere. A chamber a little smaller than an egg crate is exposed to short wavelengths—ultra-violet rays—until the air it contains has been sterilized. The technician's hands and arms also are sterilized and introduced into this chamber through a device which prevents contamination. Hitherto, research with the ultra-microscope has been inconclusive because it has seemed impossible to obtain uncontaminated cultures. Miss Chevassut's technique appears to be a great step forward in this direction, and to have made the isolation of "creeping paralysis" germs possible.

A blood serum, known as Hartley's broth, is used for the cultures. Virus from the cerebro-spinal fluid of persons suffering from the disease is introduced into the culture tubes in the sterile chamber and the tubes are closed and incubated.

When the cultures are examined under a magnification of 1,800 times, spherical globules in clusters appear. When separated they have two motions, one a Brownian movement or very rapid vibration associated sometimes with inert matter under very high magnification. The other appears to be a longer oscillation comparable to the movements of some living bacilli. The apparent organisms are too small to take a stain and can be seen only on a dark field with direct illumination. As yet no nuclear material is evident.

But the fact that these forms are discovered only in the virus taken from persons suffering from the disease and that they appear to multiply in cultures suggests very strongly that they are the first organisms of a filterable virus the human eye has seen and identified.

THE CLAUDE OCEAN POWER PLANT

AN act of sabotage at the last minute in the launching of the giant tubing being laid out into the Gulf Stream at Matanzas, Cuba, to bring cold water to the Claude sea power experimental plant, caused the total loss of the 6,000 feet of tubing recently, Georges Claude, French physicist and inventor, has informed *Science Service*.

This is the second time that his attempt to tap the cool depths of the ocean has ended in disaster, yet M. Claude announced in his cable that a third large tube of insulated sheet iron was being made in France and that it would be launched at the end of August. The first conduit was lost in launching last September.

Over a mile long, over six feet in diameter, the corrugated sheet iron tube when successfully placed will reach out from the Cuban coast and suck up water from a depth of over a third of a mile. This water will have a temperature of about 50 degrees Fahrenheit.

This will provide the cooling water for Claude's unique power plant which instead of heating water by burning fuel uses the relatively hot surface water of the tropical ocean which is 35 to 40 degrees warmer than the cooling water to be brought by the conduit from the depths.

Awaiting the laying of the third conduit there may be seen, on the shore at Matanzas, Claude's unique power plant that in trial operated successfully on waste hot water at Ougree on a Belgian river. It makes use of a boiler, turbine and condenser, like ordinary steam stations. But instead of being heated by a flaming fire, his boiler is at the temperature of surface water. Instead of being subject to hundreds of pounds of pressure, its pressure would be much less than that of the atmosphere outside.

Even the low pressure of the boiler would be higher than that of the condenser, and consequently steam from it would flow through the turbine to the condenser. Water from deep in the ocean would maintain the low pressure of the condenser by cooling and condensing steam from the boiler and turbine.

Because this process involves relatively small changes of temperature and pressure, large quantities of cool condensing water and warmer boiler water are required.

Although M. Claude's experiments are costing many thousands of dollars, the present power plant is experimental rather than commercial. He intends that it operate only a few months after the cold water conduit is finally laid. The information that the ocean power plant will give him will be used in the design and construction of a modest industrial power plant of about 12,000 kilowatt capacity.

Engineers accustomed to conventional power plants have not viewed M. Claude's experiments with great enthusiasm, but his record of achieving what others have called impossible has made many confident that his plans will succeed. M. Claude is a scientist and engineer of world-wide reputation. He invented the first successful process for making liquid air and liquefying other gases; he pioneered in the field of making liquid ammonia out of the atmosphere; he is the inventor of glowing red neon lights that shine on our streets at night. His inventions are capitalized at $150,000,000 in America alone.

ROOM TEMPERATURES

THE occupants of a room in which the thermometer registers 70 degrees Fahrenheit are not necessarily warm and comfortable. In spite of the correct temperature they may be miserably cold.

Radiation from cold walls will chill them, Professors A. C. Willard and A. P. Kratz, of the University of Illinois, told the American Heating and Ventilating Society at Minneapolis. Professors Willard and Kratz were reporting the results of extensive studies and experiments of the past twelve years.

"Entirely too little attention," they said, "has been given to the radiation effect of the inside surfaces of exposed wall and glass on the personal comfort of the occupants of heated rooms, especially during the coldest weather. But the occupant in the actual room is keenly conscious of this effect, and the colder the weather and the poorer the wall construction, the more conscious of his cold surroundings he becomes even though all 'breathing line' temperatures are exactly 70 degrees."

This breathing line temperature, which is used universally in heating calculations, was declared to be an unfair measure. It is taken five feet above the floor and does not indicate the true effect of room temperature upon the occupants.

The temperature at the comfort line, two feet six inches above the floor at the average height of the zone occupied by people, should be used. Here the air is always colder than at the breathing line, how much colder depending on the type of heating plant, heating unit and house construction.

ARCTIC CLIMATES

THE old idea that Greenland and other Arctic countries were once palm-filled tropical paradises is all a myth. These regions could not have been tropical, if for no other reason than that they have practically continuous night for several months each year. Even if it had stayed warm enough, the plants standing there in the dark would have starved for lack of sunlight.

This is one of the points raised in a discussion of ancient climates in the Arctic by Professor Edward W. Berry, of the Johns Hopkins University.

Professor Berry has found, upon examining all known kinds of fossil plants from the far North, that the great majority of them belong to temperate rather than tropical genera. In the more recent geological periods they included such trees and shrubs as alder, sweet-gum, beech, oak, elm, maple, hickory, tulip-tree and sassafras, all of which are decidedly temperate-zone plants. Some more or less tropical trees have been found, such as fig and cinnamon; but Professor Berry points out that cultivated figs generally ripen their fruits as far north as Baltimore, and that many of the trees that grow in tropical latitudes have their homes high up on the mountainsides, and are therefore really temperate-climate plants after all.

The plants of older periods, such as the coal age, have all disappeared from the earth, so that we can not judge their habits and climatic requirements with anything like certainty. Such of their relatives as have survived, however, get along very well in temperate regions.

THE BEHAVIOR OF WASPS

WASPS have a strong racial feeling. They will welcome strangers belonging to their own species, even though they come from nests many miles away. But if a strange wasp of a different species alights on the nest it means instant battle.

This in outline gives the results of experiments on wasps in a number of nests which Phil Rau, of Kirkwood, Missouri, hung up in his third-floor laboratory and studied in greater intimacy than most of us would want to bestow on the slim-waisted "hot-tails." Mr. Rau's data will be given in detail in a forthcoming issue of *The Journal of Comparative Psychology*.

Mr. Rau's collection contained three species of the genus *Polistes*. He found that in general if an insect of a given species were transferred to a nest of the same species it would either be welcomed by a committee of the "home folks," or at the very least be let tolerantly alone, to make itself at home if it chose. Sometimes a stranger wasp would become a permanent member of its host colony.

A wounded wasp introduced into a strange colony of its own species would frequently receive apparently solicitous attention from its sister insects. They would lick its injuries and massage its body and wings.

As an extreme case, Mr. Rau pinned to one nest a dead wasp of the "right" species which had been kept for several years in a museum case in an atmosphere saturated with creosote vapor. Most of the wasps paid no attention to the mummy. A few made mildly hostile gestures and then became indifferent. But one determined female apparently had opinions of her own about the strange-smelling intruder, for she attacked it furiously and was not content until she had bitten off both its wings. Then she retired and treated herself to a most elaborate and lengthy toilet.

When a wasp was placed in a colony of a different species, there was no friendly welcome nor even an indifferent toleration. Everybody was up in arms at once, and the stranger usually got very short shrift unless he were lucky enough to escape. The intruder would instantly become the center of a mass of struggling, biting, sting-thrusting insects.

Their hostility was just as great against the dead body of an alien as it was against a living insect. The same mummified, creosote-flavored wasp that roused the antagonism of only a single individual in a nest of its own species produced a general riot when it was pinned on the nest of either of the two other species.

ITEMS

THE earthquake which rocked Calcutta on July 2 was probably centered some distance to the southwest of the city, in the Bay of Bengal, according to the U. S. Coast and Geodetic Survey. After study of reports gathered from seismograph stations by *Science Service*, the survey's earthquake experts announced that the quake was centered at approximately 21 degrees north latitude and 87 degrees east longitude. Seismograph stations reporting the quake were located at Georgetown University, Washington; St. Louis University; the Dominion Observatory, Ottawa, and the stations of the Coast Survey at Tucson, Arizona; Chicago, Illinois, and Honolulu.

A FIELD office to help Central American countries lay out the route of the proposed inter-American highway is being opened in Panama City by the Bureau of Public Roads of the U. S. Department of Agriculture. It will be operated by Thomas A. Forbes and D. Tucker Brown, senior highway engineers, and Marcel J. Bussard, assistant highway engineer. An appropriation of $50,000 by Congress makes this cooperation with Central American countries possible to speed work on the international highway. The entire route through Mexico has been mapped and much of the road completed. In Panama a ferry and a highway near the Pacific entrance of the Panama Canal will be built as the result of a recent act of Congress. An initial appropriation of $1,000,000 has been authorized for this work, which will fulfill a treaty obligation to provide a convenient and effective permanent crossing of the Canal and the Canal Zone.

THE wide distribution of the fish tapeworm in North America was brought to the attention of students and public health workers by Professor Henry B. Ward, of the University of Illinois, at the DeLamar lecture at the Johns Hopkins School of Hygiene and Public Health. The fact that lakes and streams of the Great Lakes region and central Canada are heavily infested with these worms has not been generally recognized until recently. Much of the population in these sections of the country has become infected with the tapeworms as a result of eating raw or insufficiently cooked fish from these waters. The tapeworm passes one stage of its existence in fish and another in man or other warm-blooded animals. The eggs discharged from human or animal intestines reach the water by way of sewage and then infect the fish. Wild animals as well as man and domestic animals are a factor in the spread of these parasites.

X-RAYS have been found helpful in the treatment of many diseases for which they are not generally used. Among these conditions are boils, carbuncles, certain cases of pneumonia, erysipelas, inflammation of the kidneys, inflammation of the parotid gland and many other inflammatory conditions, Dr. Arthur U. Desjardins, of Rochester, Minnesota, told members of the American Medical Association at the recent meeting held in Detroit. Irradiation tends to destroy the white blood cells or leucocytes, which gather to defend the body against infection. It would seem that a destruction of these defender cells would do more harm than good, but Dr. Desjardins explains that the white cells contain a substance that enables them to destroy the invading germs. Irradiation, by destroying the cell, liberates the protective substance and makes it even more readily available for defensive purposes than when it is in the intact cell.

SCIENCE NEWS

Science Service, Washington, D. C.

ROCKET EXPERIMENTS

FROM a small depression in a remote corner of Camp Devens, near Worcester, Massachusetts, rockets will sail upwards from a steel tower to heights that can not be predicted with certainty. Perhaps their greatest altitude for some time to come will be measured in only thousands, or even hundreds, of feet, but from them scientists are looking forward to the time when they will be able to explore heights above the earth far greater than any reached by airplanes or balloons.

The Camp Devens experiment is part of the work of Dr. Robert H. Goddard, professor of physics at Clark University. Dr. Goddard is one of the pioneer students of this form of locomotion. It was in 1912, while at Princeton University, that he began his researches. In 1914 he went to Clark, where he has worked ever since. Much of his work has been done with the assistance of the Smithsonian Institution and later of the Carnegie Institution of Washington. In 1919 the Smithsonian Institution published his first report on his work in which he outlined his theories and experiments.

Referring to this report, Dr. C. G. Abbot, secretary of the Smithsonian Institution, said recently: "Professor Goddard's basic inventions of 1914, whereby he applied the correct angle gas orifice; his later successful introduction of continuously burning liquid propellants, and his mathematical theory, published by the institution in 1919, form the foundation on which important events in the exploration of the air will probably depend."

So important have been Dr. Goddard's researches, and so much do they promise, that now a grant has been made to him by Mr. Daniel Guggenheim in order that he may continue them with adequate facilities. An advisory committee has been appointed, consisting of Dr. Abbot; Dr. J. C. Merriam, president of the Carnegie Institution of Washington; Dr. Charles F. Marvin, chief of the U. S. Weather Bureau; Dr. R. A. Millikan, of the California Institute of Technology; Dr. Walter S. Adams, director of the Mount Wilson Observatory; Dr. John A. Fleming, acting director of the Carnegie Institution's Department of Terrestrial Magnetism; Colonel Chas. A. Lindbergh and Henry Breckinridge.

The Goddard rocket is essentially the same as the fourth of July pyrotechnic, in that it is propelled by the recoil from the discharge of gases. This is quite different from the way an airplane is propelled, for example, which depends upon an actual push against the atmosphere. As a result, the rocket will work just as well outside the earth's atmosphere as in it; in fact, since the air causes a certain amount of resistance, it would theoretically work better in a vacuum. Professor Goddard has perfected a liquid propellant for his rocket which has many advantages over gunpowder or similar explosives. As this burns up as it is used, the rocket continually becomes lighter. In scientific exploration of the upper atmosphere, above the present altitude records, instruments would be carried up, and a parachute would bring them safely to earth after the charge had been exhausted.

Dr. Goddard does not promise when he will be able to send rockets up to these great altitudes. The only ones he has fired so far are small affairs, which have only ascended a few hundred feet. Similar rockets will be fired from the Camp Devens station, though increasingly higher and higher altitudes should be attained. He compares his present experiments with the first efforts of the Wright brothers, who flew only a few feet, but whose work laid the foundation for the present high development of the airplane.

After the rocket is perfected, it is expected that it will be possible to study the spectrum of the sun without the screening effect of the ozone layer 50 to 75 miles above the earth, which cuts out a large part of the solar radiation. Knowledge will doubtless be gained of the Kennelly-Heaviside layer, the ionized stratum in the atmosphere that makes possible long-distance radio. Samples of the atmosphere from these high altitudes may be brought down for analysis, and it may prove that at these heights what rarefied atmosphere there is consists mainly of hydrogen and helium instead of oxygen and nitrogen.

THE INTERNATIONAL MEETING OF PHARMACISTS IN STOCKHOLM

THE contents of ships' medicine chests and who should be responsible for them is one of the problems being discussed by pharmacists at the meeting of the International Pharmaceutical Federation which opened at Stockholm on July 16. This organization has for members the principal pharmaceutical societies of thirty-two countries in Europe, North and South America, Australia, New Zealand and Africa.

A special committee reported on present practices of various countries with regard to ships' medicine chests. These vary widely from Spain, which has no regulations and no inspection, to Germany, which has very complete regulations and requires at least an annual inspection by a competent person. The United States has apparently no special regulations governing the supply of medicines to ships beyond those governing the ordinary practice of pharmacy. The officers of the U. S. Public Health Service are the persons responsible for seeing that adequate supplies of medicines are carried on board the vessels.

The commission recommended that the supply of medicines and surgical appliances to ships should be made by pharmacists only, and preferably by those able to visit personally the ships they supply. Every ship should carry a list of the supplies of this sort which it is required to carry by the regulations of its country. No ship except those making short voyages should be permitted to clear from port until the master is in possession of a certificate from a doctor or pharmacist that the stocks of medicines and appliances prescribed on the

list are complete. The commission also recommended that the federation publish an international formulary of ships' medicines.

The commercialization of pharmacy was attacked in a report on the influence of the chemical and pharmaceutical industries on the practice of pharmacy made by Dr. J. H. Hofmann, of Holland, and Dr. A. Schamelhout, of Belgium. These investigators found that with the present system in most countries, physicians are more and more prescribing proprietary medicines instead of writing prescriptions of their own for the pharmacist to fill. This has tended to make the pharmacist a merchant, and to deprive him of his professional status. The report recommended governmental regulations of pharmacists and their shops and greater emphasis in medical schools on study of drugs and prescription writing, as remedies for the present situation.

MALNUTRITION IN PORTO RICO

SERIOUS malnutrition in Porto Rico, particularly among children, is reported by Professor H. C. Sherman, specialist in food chemistry at Columbia University. Professor Sherman spent some time this year at the School of Tropical Medicine in San Juan, where he lectured and studied the food problems of the people of the island.

Development of Porto Rico's sugar and tobacco plantations has put much land into the hands of absentee landlords who bought out the small farmers. Thousands of these farming families have thus entered the casual labor group to compete for jobs and to buy food at increasing prices, Dr. Sherman states in *The Journal of Home Economics*.

"The great majority of the people of Porto Rico must live almost entirely upon whatever food will satisfy hunger at the expenditure of the fewest pennies. Usually this is rice and beans.

"It must be emphasized," he continues, "that the food supply is inadequate as well as ill-balanced, for it would be a tragic error to try to reduce their supply of rice and beans in order to balance their diet. They are not getting too much of rice and beans, but they are getting too little of other foods."

Milk is especially needed and this need can best be met now by shipping canned and dried milk from the United States. Dairy cattle-raising is handicapped in the island because of the shortage of pasture land and because parasites prey heavily on cattle. Supplementary feeding for school children and orphans is being introduced in some places to meet the malnutrition.

The situation is a vicious circle of poverty, undernutrition and impaired efficiency which must be broken.

THE CAUSE OF GINGER PARALYSIS

A SUBSTANCE related to carbolic acid is probably the adulterant which caused thousands of cases of paralysis from drinking Jamaica ginger last February and March.

A phenol compound, probably the phosphoric acid ester of tricresol, is the substance which Dr. M. I. Smith, of the U. S. Hygienic Laboratory, working with the Prohibition Bureau, found in samples of the ginger from shipments that had caused cases of the paralysis. Samples from shipments thought but not definitely known to have caused paralysis also contained this substance. Samples from lots that did not cause paralysis did not contain any of the phenol compound.

Samples from the first two classes of shipments were fed to rabbits, monkeys and dogs. The monkeys and dogs were not affected, but the rabbits became paralyzed in the limbs and died of respiratory failure.

An adulterated fluid extract of ginger was made in the laboratory to resemble the ginger that had caused the outbreaks of paralysis in human beings. This extract contained tricresyl phosphate, the suspected compound. It had the same effect on the animals as the samples of the ginger which were known or thought to have caused the human disease.

The government scientists were at a loss to explain why the monkeys and dogs were not affected by the ginger samples, but they found that paralytic symptoms could be produced when the suspected phenol compound was broken down chemically before being given to the dogs and monkeys. This suggested that the compound passed through the stomachs of these animals unchanged, while in the stomachs of rabbits and of man it was broken down into a poisonous substance.

INSECT BEHAVIOR

DR. FRANK E. LUTZ, of the American Museum of Natural History, has added to the stock of perplexing riddles of insect behavior by a series of experiments performed on the larvae of caddis flies. These infant insects have shown an adaptiveness in their behavior that in some instances looks as though it contained an element of deliberate choice.

Caddis flies are somewhat primitive insects, whose larvae live in the water. They make a cocoon-like case in which they live. The case is spun of silky threads, and in most species is reinforced with various foreign objects which the larva picks up and builds into its walls. Some species use bits of twigs and leaf-stems exclusively; others, living in swifter waters, use small pebbles and grains of sand.

Dr. Lutz deprived a number of larvae of their cases and then put them in vessels of water with building-materials to which they were not accustomed. He gave the stem-users only sand and pebbles and the pebble-users only stems and decayed leaves. Inasmuch as the ancestors of these insects had been using only their preferred materials for millions of years, the larvae were thus suddenly confronted with as severe a problem as though one were to transplant a Hottentot to Greenland and expect him to build a snow igloo.

The larvae met their problems and solved them, some responding readily, others more reluctantly. But they all built themselves new houses out of the unaccustomed materials. The stem-building species showed some signs of ancestral habit when they had to work with sand, for they chose the long, cylindrical particles formed from

broken sea-urchin spines. But the sand-builders with nothing but leaves to use worked out an entirely new technique. They bit the leaves into suitably sized pieces and then worked these into the walls of their dwellings.

WILD ASSES AND OSTRICHES IN PALESTINE

THE wild ass and his sons still scamper and bray in the Syrian desert. And wild ostriches still make their nests about the ruins of the once proud Greco-Roman city of Palmyra.

A recent expedition into the Syrian hinterland, sent out by the Hebrew University of Jerusalem, has determined that these animals still exist, and has brought back to headquarters a number of other species new to science. The scientific personnel of the expedition consisted of I. Aharoni, zoologist; M. Zohary, botanist; Miss F. Eckman, parasitologist, and George Halil Tahan, hunter.

It was found that although the wild ass, mentioned in the Bible, has become extinct over a large part of his former range, he may still be found on a long, narrow strip of territory stretching from Mosul toward Persia.

The Syrian ostrich was seen in the vicinity of Palmyra, and three of its eggs were purchased from an Arab. They were smaller than other ostrich eggs, and Mr. Aharoni is of the opinion that the birds may turn out to be a distinct subspecies.

Another prize brought back by the expedition consists of two fine skeletons of the cheetah, or hunting leopard. This animal is domesticated and used like a hunting dog in some parts of Asia, but these particular specimens were hunting "on their own" too near a flock of sheep. They were shot by a French official of the Syrian mandate, M. Paul Clerc, and presented by him to the Hebrew University.

Many smaller animals were observed and collected. Of one rare species, the Syrian squirrel, three living and thirteen dead specimens were brought in. This little animal seems to be a communist, for colonies of five or six of them will store nuts and other food supplies in a common cache in a hollow tree.

Small birds were also investigated by the expedition. One occurrence vividly illustrated the literal accuracy of the verse in the Book of Proverbs: "The eye that mocketh at his father . . . the ravens of the valley shall pluck it out." A wounded magpie had been captured, and was placed near an owl, also injured. The magpie promptly tried to pluck out the owl's eyes. Mr. Aharoni states that this bird always attacks the eyes first.

ITEMS

SPECIAL orders to quarantine officers in Manila and on the west coast of this country have been issued by the U. S. Public Health Service in order to prevent any spread of cholera from the Philippine Islands to this country. Eight hundred cases have been reported unofficially from the Philippines, although the official figures are considerably lower than this. Passengers for the United States are not allowed to board vessels at Manila unless bacteriological tests have shown them to be free of the germs of this disease. If these tests are not made, the passengers must be kept under observation for five days before sailing. Quarantine officers are ordered to be on the watch for cases of the disease in vessels arriving from the Philippines.

STATISTICIANS of the Metropolitan Life Insurance Company have found in a survey of vital statistics that fewer deaths from pernicious anemia have been reported since the treatment with liver or liver extract has become countrywide. This statistical proof bears out the impression of doctors and pathologists throughout the country. Since the introduction of the treatment by Drs. George R. Minot and William P. Murphy, of the Harvard Medical School, the deaths from the disease, and even cases of it, have become comparatively rare in the hospitals. Since 1926, when the liver treatment was first introduced, the mortality for whites has been reduced by about half between the ages of 55 and 74 years, when formerly the heaviest mortality from this disease occurred.

ABOUT 250,000 deaths resulted from influenza epidemics in this country between January, 1920, and the middle of 1929, according to a report issued by the U. S. Public Health Service. These figures are based on the records of 95 cities for six epidemics occurring one each in 1920, 1922, 1923, 1926, the spring of 1928 and the winter of 1928–29. This total is nearly half that of deaths in the United States during the great pandemic of 1918–19. The last epidemic of 1928–29 accounted for about one fifth of the quarter-million deaths, or 50,000, while another 100,000 occurred during the sharp epidemic of the spring of 1920.

A POISONOUS substance known as lyso-lecithin has been found in ordinary polished rice by a Japanese investigator, Dr. Motoe Iwata, working at the biochemical laboratory of the Institute of Physical and Chemical Research at Tokyo. The poisonous substance was only obtained after repeated extraction with alcohol, so that it could hardly have any effect on human beings through ordinary consumption of the cereal. However, it may have some relation to the factor in polished rice which causes the nervous disease, beri-beri. This will be investigated later. Beri-beri has previously been thought to be due to absence of vitamin B in polished rice, when the latter has been the chief food of affected persons.

THAT there appears to be no real danger that locusts will become a serious pest in Mexico at this time is the belief of Dr. Alfons Dampf, in charge of technical investigations in pest control work of the Mexican Ministry of Agriculture. Locusts are swarming in Yucatan, but they always exist in that state. In the fields they are fought with sprays and oil, while the brush in which they sometimes appear is burned. This type of locust hardly ever goes farther north in Mexico than the states of Jalisco and Nayarit.

SCIENCE NEWS

Science Service, Washington, D. C.

THE INTERNATIONAL CONGRESS OF SOIL SCIENCE

SOIL nitrates, one of the most important classes of plant nutrients, are materially increased by the addition of other fertilizers in proper amounts. This is the central idea of a paper by Professor A. B. Beaumont of Massachusetts Agricultural College, before the second International Congress of Soil Science, which opened at Leningrad on July 20. He added graded amounts of various types of fertilizer to different kinds of soils, and tested for increase or decrease in nitrates. Lime, he found, increased the nitrate concentration, in amounts up to six tons of lime to the acre. Beyond that amount lime was not beneficial; in some cases large amounts depressed nitrification. Green crops plowed under checked nitrification for three or four weeks, but after that time nitrates again accumulated rapidly. The addition of nitrate fertilizers naturally increased the amount of soil nitrates, but in some instances it was found that the natural reactions and biological activities in the soil increased the soil nitrates over the figure allowed for even in adding the nitrogen fertilizers. Only one non-nitrogenous fertilizer element, phosphorus, had a consistent tendency to decrease soil nitrification.

FLOWERPOTS that water themselves were demonstrated before a large group of Russian and foreign scientists by Professor E. P. Deatrick of West Virginia University. The device used is known as the auto-irrigator, and is the invention of Professor B. E. Livingston of the Johns Hopkins University. It consists of a cone-shaped vessel of porous porcelain, to the neck of which a glass tube can be attached, leading to a water reservoir. As the plant removes water from the soil, the soil permits water to ooze out through the walls of the cone, maintaining an even state of moisture much more satisfactorily and with much less labor than is the case with the old method of pouring water into the pots from the top. Professor Deatrick showed results from experiments conducted with a battery of 150 four-gallon pots, all equipped with auto-irrigator systems.

PROFESSOR S. KRAVKOV has developed a method for restoring fertility to apparently exhausted soils without the use of fertilizers. It consists of keeping the soil to be treated under optimum physical conditions, especially as regards temperature, moisture and aeration, while the natural microbiotic population builds itself up and captures nitrogen from the air. Professor Kravkov stated that he had increased the nitrogen content of "podsol," a poor, gray soil found in certain forest lands, approximately tenfold by his method.

To find out how little lime there is in the soil, find out how much iron there is in the plants that grow on it. This, in rough outline, is the field method of soil analysis used by Professor Oscar Eckstein, of Berlin. It is not of much practical value, Professor Eckstein said, to determine by analysis the total calcium content of a soil. Not all the calcium in it is available to plants, and it is only the available calcium that really counts. But it has been learned that there is an antagonism between calcium and iron, and when a plant gets too little calcium it is very apt to take up an excess of iron. Iron in a plant stem can be detected very easily, by means of several different chemicals that cause a change of color when it is present. So by this indirect method it is possible to determine whether or not there is sufficient calcium in a given piece of land.

IRON in the soil has a constant tendency to break up aluminum compounds it finds there and set the aluminum adrift. This is indicated by experiments reported by Dr. J. S. Joffe, of the New Jersey Agricultural Experiment Station. Analyses of river waters showed that ordinarily they contain more aluminum than iron. In an endeavor to learn how this comes about, Dr. Joffe added a soluble iron compound to samples of soil, and found that in the solutions he got out again the iron had decreased in concentration, having been captured and held by the soil, accompanied by a release of aluminum. But when soil containing a good deal of iron had a soluble aluminum compound added, it did not lose any of the iron.

SULPHUR must take its place on the list of approved fertilizer minerals, at least for certain types of land. Such is the indication of experiments performed by Professor W. L. Powers, of the Oregon Agricultural Experiment Station. Professor Powers has attacked the problem of black alkali, one of the most hopeless types of land ruin in the arid and irrigated West. He found that applications of sulphur, especially when used in combination with a nitrogen-rich organic fertilizer, will reclaim such land and make it yield good crops. Even normal land is often benefited by sulphur application, he found. Sulphur-treated fields produced higher yields of alfalfa, which had a richer, greener growth than that of the unsulphured fields.

NITROGEN-FIXING bacteria are active even in the arid soils of the desert, according to Professor P. S. Burgess, of the Arizona Agricultural Experiment Station. We usually think of these nitrogen-capturing microbes as active only in soils where higher plants leave something for them to feed on; but Professor Burgess found that in the desert soils there were enough algae, free-living one-celled plants, to supply at least part of the foodstuffs needed by the bacteria. The bacteria are able to thrive also in the presence of rather high concentrations of alkali.

BACTERIA are the chief chemists of the multiplex changes of material that are constantly going on in the

soil. We have begun to understand their work, but our understanding so far is only a beginning, and soil microbiology is on the threshold of a development that will dwarf all present accomplishments in that field. These were among the ideas presented by Professor Selman I. Waksman, of the New Jersey Agricultural Experiment Station. Professor Waksman's paper summed up the present status of soil microbiology, with special stress on recent developments. While soil microbiology is rapidly growing up into an independent branch of science, its future still depends on its continued contact with its parent sciences, Professor Waksman emphasized. General bacteriology and the study of the fungi, on the one hand, and soil chemistry on the other, will both make large contributions to its development and receive new growth themselves from the data which it will produce.

EVERY plant that sends its roots down into the soil gathers to itself a great crowd of microscopic hangers-on, like the vassals around a baron of old. It greatly promotes the growth of soil bacteria and to a less degree it encourages fungi and other soil microbes, according to Professor Robert L. Starkey, of the New Jersey Agricultural Experiment Station. Plants seem to produce a substance or substances through their roots, that bacteria find available for their needs, for the microorganisms grow thickest in immediate contact with the roots and are much scarcer a fraction of an inch away.

THE FOOD OF MALARIA MOSQUITOES

Two Russian investigators, Drs. N. Kadletz and L. Kusmina, have devised a method for forcibly feeding malaria mosquitoes. They imprison a captured mosquito between a slip of thin glass or cellophane and a fold of soft paper, tightly enough to hold her but not so tightly as to break any legs or wings. Then they slip an exceedingly fine glass tube over her proboscis, and by this means feed her on any liquid they wish to try out. In a large percentage of cases the captive mosquito will begin pumping as soon as the liquid comes into contact with her mouthparts.

This forcible feeding method makes it possible to try out many other things besides blood, and thus to study the mosquito's food preferences, her digestive reactions and her susceptibility to various poisons.

One of the first results of the experiments was the interesting discovery that mosquitoes like syrups better than they do blood. In one "run," the insects consented to drink in 90 per cent. of all tries with sweetened water, but took blood in only 48 per cent. This indicates, in the opinion of Drs. Kadletz and Kusmina, that the preferred diet of even female mosquitoes may after all be plant nectars and saps, and that they develop ogreish appetites only on occasion.

Mosquitoes can be fooled, too. Glycerin, which has no food value, apparently tastes sweet to them just as it does to us, for they drink it as though it were a syrup. But when they do, it does not seem to have the same reaction in the digestive tract, for only the crop, or front part of the tube, becomes filled, whereas when blood or a salty bouillon is fed the whole abdomen swells.

Tests were made with hibernating mosquitoes. Some of the insects store up fat like bears in summer, and like bears they live on their fat while they doze the winter through. If such hibernating mosquitoes are roused by warming, most of them will refuse to feed, even if their beaks are left in the feeding tube for a long time. But some of them will accept syrup or blood; and this willingness of a few of the hibernators to take a meal may explain the occasional mysterious attacks of malaria that occur in winter when there are supposedly no mosquitoes around.

When offered unknown fluids, mosquitoes react differently, according to the nature of the stuff in the tube. They can be tricked into drinking poisons, such as formalin, quinine and corrosive alkalies, as if they were ordinary water. But they will not take any kind of ethereal oil, even in the smallest quantity. Syrups which the insects had previously drunk with eagerness were flatly refused when a trace of clove oil was added.

MILK FROM SUN-BATHED COWS

SUN-BATHS for cows may have advertising value, but experimental evidence shows that milk from them does not have the power to prevent rickets. A group of scientists at the University of Wisconsin report in a recent journal the findings of a series of experiments which show rather conclusively that "daily exposure of cows to sunlight has little if any effect upon the antirachitic potency of milk."

The flavor and general quality of summer-produced butter has suggested to scientists as well as to laymen that there may also be a difference in the vitamin value of milk from cows which have been in sunlight and those which have been kept in a barn all the time.

Vitamin D prevents rickets by promoting the formation of calcium phosphate in bones. Animals, both human and otherwise, obtain vitamin D either from food or from the action of sunlight upon their bodies. The source of the vitamin D which the cow puts into her milk is of greatest importance. It is especially necessary that cows get this particular vitamin, since babies are so completely dependent upon milk for their supply of this rickets-preventing vitamin.

Early investigators in the field of vitamins were inclined to believe that milk from sun-bathed cows showed greater powers of bone growth. The burden of proof points to the fact that "well recognized superior quality of summer-produced butter and milk must have its primary origin in other factors than sunlight acting directly upon the cows." The authors state that in all of their experiments "no improvement in milk or butter fat secretion was observed."

E. M. Luce, who is also working in this field, is quoted by the authors as concluding from experiments that any antirachitic properties of milk depended not upon the amount of sunlight the cows had, but upon their diet. This knowledge is of vital importance to the owners of dairy herds, especially those whose dairies supply the milk for thousands of city children, whose chance at sunlight is pretty small. It is not sufficient that cows have sunlight. They must be fed rations which contain vita-

min D ready made, in order that their milk will keep children from having rickets.

THE IDAHO FOSSIL HORSE

FOSSIL bones of a new species of extinct horse, discovered in Idaho by J. W. Gidley, of the U. S. National Museum, have made an evolutionary prediction good, just as the recently found planet Pluto made an astronomical prediction good.

When paleontologists arranged all the fossils of the many extinct horse species in the order of their geologic age some years ago it was found that they also fell into a structural order. They showed graded series of characters that fairly shouted "evolution." Most notable were the step-like increase in size, and the decrease in the number of toes from five in the little Eohippus to one in the modern horse.

There were three gaps in the series, however, and it was predicted from the characters of the species on either side of each gap what the animal would be like that filled it when it was finally discovered. Two of the gaps have now been filled, Mr. Gidley's find constituting a new species of the genus immediately below the modern, one-toed horse.

The skeletons and skulls of the horses found by Mr. Gidley were buried in what seems to have been a bog-hole in a watercourse. There was a great mass of plant material along with the bones, consisting principally of leaves and twigs of trees, of species as yet unidentified. It is unusual to find fossil plant and animal remains in the same place, for the conditions required for their preservation are not always alike. In the present instance, the plant remains influenced the character of the fossils, for the bones from the lower part of the pit are darkly stained with bog-iron, leached out of the leaves.

Other animal remains found in the pit with the horse skeletons represent a species of giant peccary or wild hog, a large beaver, a mastodon, an animal that is probably a badger, an otter-like animal, turtles, frogs and fish. Outside the pit but in the same neighborhood and in the same geological deposit Mr. Gidley found a small mastodon, only seven or eight feet high, and a cat about the size of a small mountain lion. Both of these may be new species. In addition he found bones of two species of camel, one of them about the same size as the modern camel and the other much longer-legged and longer-necked. There were also bones of a small sloth, of the giant peccary, and of beavers, pocket gophers and field mice.

ITEMS

BECAUSE of a year's delay in obtaining radium for the Marie Curie Radium Institute of Warsaw, for which Madame Curie was given $50,000 in 1929 by a group of Americans, the hospital will not be able to open its doors until December. The delay has had its advantages, however, for the interest on the money will be sufficient to purchase platinum screens for the radium when it becomes available. Madame Curie said that the demand for radium was now so great that the producers are far behind in filling their orders. Only one gram is required for the Warsaw hospital, and although it was ordered last November when Madame Curie returned with the purchase money, its delivery will require another five months.

INSECTS that are worth ten dollars a million are cheap at the price, for they prey on the eggs of other insects, thereby preventing the pests from ever seeing the light. They are the almost microscopic wasps known as *Trichogramma* which are reared in captivity by Stanley E. Flanders, entomologist of the Citrus Experiment Station. Mr. Flanders has been at this work for some time now, and has improved his rearing methods to a point where the tiny parasites can be produced at a thousand for a cent. They are shipped out in great numbers to orchardists, who release them to assist in their endless warfare on fruit-spoiling insect pests.

A PIECE of petrified wood from Yellowstone National Park, so perfectly preserved that even the finest microscopic details are practically as clear under the high-power lens as those of modern wood, is described and illustrated in *The American Journal of Botany* by Professor H. S. Conard, of Grinnell College. It was found in a region where the only previously described petrified woods were those of redwood trees, but its structure is more closely akin to that of one of the species of pine found in the park. Before it could be studied and photographed under the microscope, bits of it had to be ground down thinner than tissue paper, so that the light would shine through it.

TWIN snowflakes are responsible for the optical effect known as mock suns, or sun dogs. These are luminous spots that sometimes appear in the sky near the sun, observed in snowy weather in high altitudes. At the meeting of the American Meteorological Society, held in connection with the Pacific Division of the American Association for the Advancement of Science, Dr. John Mead Adams, of the University of California at Los Angeles, announced that he had produced these crystals artificially. The microscopic crystals that are born twins develop into a T-shaped crystal that refracts the light to produce the effect.

IT has been an accepted theory among sportsmen and commercial fishermen that salmon always return to spawn in the river where they were hatched and from where they travel out to sea. Last year a six-mile commercial aqueduct was opened, emptying into Grays Harbor, Washington. At the spawning time this spring, numbers of salmon entered the great pipe at the point where it pours its fresh water into the bay and traveled the six miles to where the pipe begins in an artificial lake. The fish were seen entering the pipe and were later found in the lake. According to the water superintendent there are now thousands of baby salmon in the lake.

SCIENCE NEWS

Science Service, Washington, D. C.

SHOOTING STARS

PUBLIC cooperation with astronomers in observing the shooting stars seen in the August night sky has been requested by Dr. Charles P. Olivier, professor of astronomy and director of the Flower Observatory of the University of Pennsylvania. Dr. Olivier spoke by radio under the auspices of *Science Service*, through a nation-wide network of stations associated with the Columbia Broadcasting System.

Explaining that the talk was given at this time because "the month of August is, of all months in the average year, the one during which most meteors or shooting stars are likely to be seen," Dr. Olivier gave the reason for their greater numbers.

"The explanation is that the Earth, in its annual path around the Sun, passes through some regions of space where it meets more meteors than elsewhere. August is the month when we run into the densest part of that meteor stream known as the Perseid. Some Perseids may be seen every clear night after July 20 and up to August 16. Their greatest numbers are seen on the nights of August 11 or 12, usually the former date. On this night, if the moon is not shining, and one watches from a place with unobstructed view, and the sky is perfectly clear, sometimes over 100 meteors per hour may be seen.

"However, nearness to the lights and smoke of a city, the least fog or haze, or moonlight, will any one of them cut down the numbers seen greatly, for naturally there are more fainter than brighter meteors, and the former are those not visible unless the sky is very clear.

"Persons desirous of seeing the Perseids should therefore try to observe from a favorable place in the country. This year, unfortunately, the moon will be full on August 9, hence it will still be very bright on August 11 and 12. Nevertheless, it will be in the far south, while the Perseid radiant arises in the northeast and will be on the meridian, overhead, by dawn. So all fairly bright Perseids in the northern half of the sky will be readily visible."

Chasing meteors is a sport that requires late hours, Dr. Olivier explained. Because of the relative motion of the Earth and the meteors, fewest shooting stars are seen at 6:00 P. M., while most are visible two hours before sunrise. In observing them, the work of the professional astronomers is supplemented by a group of amateurs, formed into the American Meteor Society. But Dr. Olivier requested the help of others, even those only temporarily interested. Any one who is willing to observe them during this month, especially on the nights of the eleventh and twelfth, can furnish real assistance.

"One should choose a favorable place and provide himself with a watch, notebook, flashlight and pencil. Then, watching as large an area of the sky as possible he should count every meteor certainly seen during each half hour. As each interval is up, the record should be made in the notebook, along with notes as to any changes in the sky like passing clouds, etc., or any especially fine meteors seen. The watching should be done toward one direction only, during each half hour. What direction it is should be recorded. If desired, other directions may be chosen for other half hours. No meteor should be counted unless seen with certainty. Full notes as to condition of the sky should always be made.

"Such records, conscientiously made by intelligent people, over periods of two or more hours near the dates of maximum of the Perseids, for instance, have a real value. When reported to us, they are published in due time, proper acknowledgments being made to each contributor, by name, in the publication. We also desire all observations of any very bright meteor, casually seen, no matter on what night.

"For those who would like to take part in more detailed observations than those briefly outlined, a request mailed to the Flower Observatory, Upper Darby, Pennsylvania, will bring a bulletin with further instructions and descriptions of the work of the American Meteor Society. The society is always glad to get new members, for as yet there are many of our states without a single active observer therein."

THE DETECTION OF GAS LEAKS

ENGINEERS of the U. S. Bureau of Mines have developed a warning chemical of terrible smell that they urge should be added to odorless illuminating and fuel gases by gas companies before the fuel is placed in city mains.

Ethyl mercaptan, an organic sulfur compound, is the smelly stuff that would be added to provide an unmistakable signal of escaped gas. It has such an intense, disagreeable odor that only one hundredth of a pound of it in a million cubic feet of air will warn. Gas companies could put about eight pounds of it in each million feet of gas and any slow leaks in houses would soon be detected, whereas about forty pounds per million cubic feet of gas would allow their inspectors to detect leaks in mains and service lines underground.

Most manufactured gas has an odor that can be detected when the gas escapes into a room, but natural gas is practically odorless. This is because natural gas is practically pure methane, CH_4. Artificial gas, however, in the process of its manufacture from coal accumulates oxygen and complicated compounds of methane, ethylene and acetylene which cause the odor.

Natural gas was until recent years allowed to escape from wells but is now piped to a distance of a thousand miles in many cases superseding coal as a fuel in industry. This has brought forward the problem of safe and economic distribution over vast gas systems and made necessary the evolution of a super-smell like ethyl mercaptan.

Possibilities of using ethyl mercaptan for a danger signal were first tested about 10 years ago in mines. A

little of it was put in the air supply lines and within 5 or 10 minutes the miners were beating a hasty exit.

Ethyl mercaptan is a liquid closely related to the alcohols, and is sometimes called thio-alcohol.

THE SUFFOCATION OF FISH

FISH dying in an abundance of water, because they were not getting enough of air that is traditionally supposed to be fatal to them, have been the subjects of study in two German laboratories during the past few months. The researches were prompted by the fact that great numbers of fish died of suffocation under the thick ice produced by last winter, which was unusually severe in Europe; and scientists wanted to know, for both practical and theoretical purposes, just how much oxygen has to be dissolved in water in order to sustain fish life.

Goldfish and carp became distressed and finally died when the oxygen in the water fell to a concentration of from four one hundredths to one tenth of one per cent. Whiting, perch and several other species of fish showed signs of distress at one tenth of a per cent., and died when the concentration fell below eight one hundredths of one per cent.

The requirements of trout, earlier experiments showed, are higher. This active fish can get along on water containing from five tenths to eight tenths of one per cent. of oxygen, finds one third that much insufficient, and dies if the oxygen falls below that. Carp can live easily where trout find it suffocating, can endure what kills a trout, but finally die at the low figure of five one hundredths of one per cent.

Tenacity of life under ordinary hardships does not seem to have anything to do with ability to withstand low oxygen rations. Observers noted last winter that eels, one of the hardest to kill of all fish, were the first to suffocate when thick ice cut off the air supply from their water.

IMMUNIZATION AGAINST CHOLERA

PLANS for wholesale immunization against cholera, by which whole towns may be protected from the dread disease of the Orient, are now being considered. These plans are based on recent investigations with the bacteriophage, or germ-killer, taken from patients getting over an attack of cholera. If the plans prove practical, there may soon be a time when entire communities can be immunized against Asiatic cholera and epidemics of that disease may cease.

The Indian Government has invited Professor F. d'Herelle, of Yale University, discoverer of the bacteriophage, Major R. H. Malone, officiating director of the Pasteur Institute at Kasauli, and Dr. M. N. Lahiri to investigate the new discovery that bacteriophage, which is virulent for the cholera germ when taken from a convalescent cholera patient, acts as a prophylactic when administered to the uninfected and as a remedy for those who have already contracted the disease.

Bacteriophage, it is thought, is a normal inhabitant of the intestine and is a parasite on the microorganisms found there. It was discovered after an epidemic of cholera that as soon as the bacteriophage from convalescent patients became diffused through natural means into the water used by the community, the epidemic ceased. This is the fact that the scientists are using as a basis for their investigations. Their suggestion is that potent strains of bacteriophage be grown deliberately and these cultures be introduced directly into the wells, thus immunizing whole communities at one time.

As a remedy when the individual has contracted the disease the bacteriophage has been found very efficacious. If it was given within six hours of the first symptoms, there were no deaths; if administered between six and twenty-four hours the mortality rate was 10.2 per cent., but after twenty-four hours the rate rose to 14.3 per cent.

The bacteriophage is said to be entirely harmless when given by mouth. There is a special warning that it should never be administered by infection under the skin.

ASTHMA TRACED TO MOLD

A COMMON form of mold which flourishes in American soil and finds its way into damp houses to thrive there in the dirt is now accused of being a cause of asthma. A case of asthma which persisted for nine years and which has finally been traced to sensitiveness to this type of mold has been reported to the American Medical Association by Dr. Harry S. Bernton, of the Georgetown University School of Medicine.

This is the second case of asthma traced to mold in this country, and is the first traced to this kind of mold. Dr. Bernton, who has been testing asthmatic patients for sensitiveness to molds since 1923, believes that molds may prove to be inportant as causative factors in this disease. Many cases of asthma are now classed as "non-reactors," because no specific irritant has yet been found which is the cause of their distress. The new work with molds makes it likely that some of these cases may be cleared up.

Dr. Charles Thom, specialist in molds of the U. S. Department of Agriculture, has cooperated with Dr. Bernton by supplying him with sixteen kinds of molds, which have been used in tests upon patients, in the search for their particular irritant.

The young woman whose asthma proved due to a mold had lived in a damp and musty house for six years, and it was apparently in this house that her nose and throat linings became sensitized to mold-laden air.

While molds are a recently discovered cause of asthma, and only two cases have been found in America, European physicians have been finding a considerable proportion of asthmatic patients sensitive to molds. Living conditions in the Old World would bring people who might be sensitive to molds more often into close contact with them, Dr. Bernton points out.

"Thatched roofs, the close proximity of domestic and food animals to human domiciles, animal food and excrement, offer fertile sites for development of molds."

CENTENARIANS

THE old Turk, Zaro Agha, with his birth certificate showing 156 years of age, who is now being proclaimed to credulous New York as the oldest human being in the world, will have a hard time convincing scientific skeptics that he has lived that many years. Old he is, without a doubt, but those who have looked into such claims in the past are laying their scientific wagers that he is not much more than a hundred or so.

In fact, the most extreme case of longevity that medical records show fully authenticated was not quite 111 years. That record was substantiated by the English investigator, Dr. T. E. Young, who in the early part of this century considered many cases of supposed centenarians and found only 30 persons who from other outside evidence could be shown to have lived a hundred years or more. Of the thirty, 21 were women and 9 were men.

Medical statisticians hold to their idea that extreme old age is a rare phenomenon although in the million or more deaths annually in the United States at least several hundred death certificates show ages of over a hundred and occasional ones will show such startling records as 120 years.

When such cases are looked into it is often found that mistaken identity confers upon the supposed centenarian his remarkable record. Repeatedly instances like this are uncovered: John Jones was born and his baptism duly recorded, but he died at the age of 15 years and his death was not registered through an oversight. In the same year that he died another male child was born to the same parents and named John Jones, perhaps in commemoration of his deceased brother. The second John Jones was never baptized. When he reaches the age of 85 or 90 his appearance of extreme senility attracts attention and the baptismal records apparently show that he is a hundred or over. The aged gentleman basks in his seemingly well-authenticated record of extreme age.

America has had its claimants to age records. Uncle John Shell, of Kentucky, who was exhibited as "the oldest living human being" with a claimed age of 131 years, was pronounced after a careful investigation of his case to be "about one hundred years old, possibly a year younger or older."

Despite the fact that authenticated cases of human longevity to over a hundred years are few, man is nearly the longest lived of all mammals. The common idea that whales and elephants attain many more years than man is not credited in scientific circles. But some species of fish may live to over 260 years according to the best evidence and reptiles are reported to have lived 175 years. Birds may have a life span of a few years longer than man in some instances.

ITEMS

A BABY orang-utan, the third born in captivity, arrived recently at the Philadelphia Zoological Gardens. The first infant orang was born in the Zoo in Nuremberg, Germany, and lived about a week. The second was born of the present mother in the Philadelphia Zoo and lived about a year. This baby was five pounds in weight at birth and is thriving. There has been a theory that the orangs seek seclusion for the birth of their young, but this mother made her nest right up against the bars of her cage in full sight of the crowds.

FOR some years it has been known that celery contains vitamins A and B. Recent research has shown that it also contains a comparatively large amount of vitamin C, the "fresh fruit" anti-scorbutic vitamin. This result has been obtained by Dr. Tomiji Matsuoka, who carried out his experiments at the Kyoto Imperial University, Japan. Guinea-pigs were used as the experimental animals. A basal diet was given on which the guinea-pigs all got scurvy. This could be cured or prevented by a small daily ration of celery stalk or leaf.

THE most important factor affecting the vitamin C content of apples is the variety of the apple. The character of the soil, age of the tree and season of picking have practically no effect. These are preliminary results of an investigation on the vitamin contents of different kinds of fruits and different varieties of one fruit which is being conducted by Mary F. Bracewell, Edward Hoyle and Dr. S. S. Zilva at the Lister Institute in London. The English cooking apple, Bramley's Seedlings, was much more active in anti-scorbutic properties than any other cooking or dessert apple which was tested.

A SUCCESSFUL, non-poisonous food-preservative may be obtained from cow's milk as a result of recent investigations reported by Drs. F. S. Jones and H. S. Simms, of the Rockefeller Institute for Medical Research at Princeton, New Jersey. The natural agent in milk which prevents the growth of micro-organisms was isolated. It is found in the whey after the routine separation of the butter-fat and casein. It can be obtained in pure form in a powder which keeps for several months. It is reported that one grain of this powder added to a gallon of the ordinary medium on which germs grow will prevent their growth.

NEW evidence that the Sahara Desert was once a well-watered, fertile region is presented by a small fossil found by an African expedition of the Logan Museum of Beloit College now being studied at the University of Chicago. The specimen is the skeleton of a cane-rat, a beast about the size of a woodchuck, which in present times is found only in thickets along the banks of streams in the more fertile parts of Central Africa. The new fossil, to be known as "Logan's cane-rat," appears to be extinct, but the conditions of the find indicate that it is not to be assigned to any remote geological period. The fossil comes from a region known as the Tanezrouft, now one of the dryest and most inhospitable parts of the central Sahara, 500 miles from the nearest flowing stream. The presence there of such an animal indicates that at the time at which it lived (probably only a few thousand years ago) the center of the Sahara was a well-watered country, and that its climate has since changed remarkably to form the present desert.

SCIENCE NEWS

Science Service, Washington, D. C.

THE INTERNATIONAL COMMITTEE ON INTELLECTUAL COOPERATION

A GROUP of intellectual leaders of the world have finished six days' consideration of how international cooperation in science, literature and art can best be promoted and stimulated. As a part of the League of Nations, the International Committee on Intellectual Cooperation is charged with coordinating the intellectual activities of the world. As is the case with many of the technical committees of the league, Americans take active part in the deliberations of this body. This year Dr. Vernon Kellogg, permanent secretary of the National Research Council, attended the sessions as alternate for Dr. R. A. Millikan.

Mme. Marie Curie and Professor Albert Einstein both took an active part in this year's meetings of the committee. M. Paul Painlevé, equally well known in French political and scientific circles, former premier of France, joined in the sessions held under the presidency of Professor Gilbert Murray, professor of Greek at the University of Oxford. Dr. Aikitu Tanakadate, professor at the University of Tokio, an advocate of the Roman alphabet for the Japanese language; Professor Alfredo Rocco, Italian minister of justice; Mlle. K. Bonnevie, professor of zoology at the University of Oslo, Norway; Sir Frank Heath, British educator and scientist, and Dr. Hugo A. D. Krüss, director of the Prussian National Library, were among the members of the committee in attendance.

One of the projects considered was the possibility of various countries exchanging secondary school children in much the same way that college students, graduates and professors have visited various foreign countries as a part of their education. Use of motion pictures in teaching science, art and literature and the possibility of international exchanges of educational films came before the committee.

How to make accessible to all research workers the vast accumulations of published data on science that are being provided by the printing presses of all countries is another problem before the committee. Whether scientific discoveries and developments should be given protection similar to that afforded inventions by patent laws is a question that received some discussion this year as well as in past annual sessions.

The committee reorganized the International Institute of Intellectual Cooperation at Paris which operates under its direction and appointed an executive committee to promote greater efficiency in the work of intellectual cooperation. The staff of the Paris institute was reduced, a program of concentration was adopted and the resignation of M. Julien Luchaire, director of the institute, was accepted. M. Henri Bonnet, of France, a League of Nations secretariat official, was elected to succeed M. Luchaire.

EROS

MAINTAINING an average speed of 15 miles per second, a little planet named Eros is on its way to visit the Earth. Eagerly awaited by astronomers all over the world, this small but fascinating member of the solar system will remain in the neighborhood of the Earth from October, 1930, to May, 1931.

The present visit is the most intimate that astronomers have enjoyed since the discovery of the eccentric little planet in 1898. Never quite visible to the naked eye, it will be easily reached by field glasses and small telescopes during several months of its stay in our vicinity.

Though believed to be only about 15 miles in diameter, Eros is the most valuable and useful member of a family of 1,100 asteroids. Owing to the fact that it will come within 16,700,000 miles of the Earth, or one fifth the Sun's distance, it will be pulled out of its elliptic path by the attraction of the Earth. By carefully measuring the amount of this deviation, astronomers can determine the extent of the Earth's gravitational power, and can compute the mass or weight of the Earth more accurately than it has been ascertained by other methods. When the number of tons of material contained in Earth are known exactly, the Sun's distance can be determined by comparing its attraction for Eros with the Earth's influence.

Many astronomers, especially R. H. Tucker, at Lick Observatory, and A. Kopff, of Berlin, have devoted years to the task of preparing accurate and dependable positions of the stars near the predicted path of Eros in order that the observations of the planet may be measured with the greatest exactness obtainable.

Early in October Eros will appear in the constellation of Auriga, having a magnitude of ten, or a hundred times dimmer than fifth magnitude stars which are easily discernible to the unaided eye on a clear night. Passing south of the familiar great dipper of Ursa Major and through Leo Minor during December, Eros will move east and southward. By January 14 it will apparently stand still for a few days at the extreme eastern limit of the loop which its apparent orbit describes among the stars. This is due to the fact that we view it from a rapidly moving Earth.

At its stationary point east, Eros will be only 14 degrees north of the celestial equator in the constellation Leo, and will be of the seventh magnitude, or 18 times brighter than in October.

Moving rapidly southward, the tiny planet will cross the equator on January 27 and will reach its closest point to the Earth on February 17. Seen from a latitude of 40 degrees north, Eros will then be only 30 degrees above the southern horizon, or a third of the way from the horizon to the zenith.

Eros will then be only 70 times as far away as the Moon. The constellation Antlia in this part of the sky has no stars brighter than fourth magnitude.

On March 15, Eros will reach the western end of the loop and its farthest point south of the equator. During this part of its visit it will be observed by astronomers of the southern hemisphere, particularly in South Africa, for whom it will be high in the sky.

Retracing its northerly path, but rapidly diminishing in brightness, the planet will say farewell to the Earth in May and vanish, not into outer darkness, but into the brightness of the Sun's radiation.

EMANATIONS FROM BUTTERFLY WINGS

BUTTERFLY wings give off something—either invisible light waves or a gas—that enables them to photograph themselves in the dark. This curious discovery has been made by Austin Clark, of the U. S. National Museum, who is now engaged in trying to find out what the mysterious emanation is.

Mr. Clark mounted the wings of butterflies on paper, which was put in the bottom of a plate box to give a flat surface. A fresh plate, emulsion side down, was placed on it, and the sealed box, with light excluded, put away for a week or so. When taken out the plate had a clear picture of the butterfly wings, complete as to detail and relative intensity of color pattern. Black patches were black, orange areas intermediate and white areas white, so that on the print black areas came out white and white areas black.

The wings of 37 species of butterflies were examined, including perfectly preserved specimens reared in the dark from fully fed caterpillars and never exposed to sunlight, specimens taken in sunlight, and others which had been dead more than 30 years. The effect was less apparent in the case of the 30-year-old specimens than in the fresh ones. The only anomaly found was that the light spots of the common blue swallow-tail came out as if they were black instead of white—a reversibility previously noted in photographing the Parnassides, another group of the swallow-tail family. Color values were the same on films and plates, whereas photographers say that they are usually, but not always, reversed on films in case of gas emanation, tentatively explained as due to interaction between the gas and the film preservative.

Exposures were made with parts of the wings covered with thin slips of glass, and others with parts covered with cellophane. The latter substance is very transparent to the short wave-lengths of light, while glass is not. The glass obliterated on the negative all portions of the wings beneath them, but the cellophane only resulted in a slight dimming of the image, with no alteration of pattern. Hence whatever causes the effect on the plate will not pass a thin cover glass, but will pass through cellophane.

This would seem to lend support to the theory that the effect is due to some kind of light waves rather than to a gas. But when Mr. Clark shielded part of a wing with a bit of thin quartz, which is even more transparent than cellophane to ultra-violet radiation, he found that the quartz blocked off the effect as completely as did glass. This leaves the nature of the cause still in doubt.

BLOOD TESTS OF PARENTAGE

ARE heredity experts justified in assuming the rôle of Solomon in a dispute between parents over the identity of their offspring? "Sometimes, only," is the answer indicated by the mass of data accumulated by science to date on this question, which has awakened such controversy in the Watkins-Bamberger suit concerning the alleged interchange of babies at the Englewood Hospital in Chicago. In many instances, the experts would be forced to shrug their shoulders without essaying a definite "Yes," or "No," to the pleas of distraught parents.

While complete reports of the findings have not been made public, newspaper accounts seem to indicate that this is a case where the blood group tests to establish parentage could apply. For the parents in question are said to belong to different blood groups and the children, according to the laws of heredity, would be distinguishable by a corresponding difference in type.

Physiologists have established that practically all human beings belong to one of four principal blood groups and that children inherit the characteristics of either one or the other of their parents, if they do not take after both. Difference in blood group is readily detectable because of the clumping or "agglutinating" effect that alien blood strains have on each other, whereas blood from different persons of the same group mingles freely.

Thus if a father and mother, both belonging to Group O, were left with the choice of two infants, of Groups O and A, respectively, theoretically the Group O baby would be their blood kin, and the A Group child could not be.

Father and Mother Watkins both happen to belong to the O Group, if published accounts are accurate. But the baby delivered to them by the hospital is of Group A, and not their child by verdict of the blood tests. Mother Bamberger, on the other hand, is said to belong to the AB Group, yet the baby in her arms is an O Group child. All of which sounds like a mixup somewhere.

One caution has been urged on modern Solomons by scientists, however. Very young infants may not have their final blood group fully established. With infants less than a month old, the test should be repeated after several months have elapsed.

If this suggestion is complied with, it will mean that the disputed pair of infants of the Watkins and Bamberger domiciles should undergo a confirming test. Then, if the published accounts of the findings are accurate, the verdict should be reasonably certain.

Some idea of the difficulty may be gleaned from a report on the chances of establishing a child's paternity by blood grouping tests, mathematically computed by Dr. Sanford B. Hooker and Dr. William C. Boyd, of the Evans Memorial for Clinical Research and Preventive Medicine of Boston. They estimate that in cases where the paternity of the father alone was brought into question, the probability of establishing non-paternity was

one to five for Group O, one to 17 for Group A, one to seven for Group B and one to two for Group AB. These probabilities are based on the frequency of distribution of the groups among the white population of the United States and upon the laws governing the inheritance of blood groups.

LOW WATER LEVELS

NEW records for low water levels on the Mississippi and other mid-western rivers are being set as the worst drought in the history of the Weather Bureau continues to threaten crops. Rivers which were breaking records for height of water a year or so ago are now far below normal. At St. Louis, for instance, the gages of the Weather Bureau show a height of only 3 feet, the lowest ever recorded at this time of year, according to M. W. Hayes, in charge of the work on rivers and floods. Normally, said Mr. Hayes, the level is something like 12 or 14 feet at the beginning of August. This height is measured above the zero of the gage, which is set approximately at the lowest possible.

All along the Mississippi River system low levels are being recorded. At Davenport it is 2 feet 7 inches; at Memphis, 4 feet 8 inches; at Cairo, 9 feet 7 inches; at Vicksburg, 8 feet 4 inches, and at New Orleans, one foot three inches. At Kansas City the Missouri is 5 feet 8 inches and at Cincinnati the Ohio is 11 feet 8 inches.

Preliminary reports reaching the Weather Bureau show that this drought is the worst ever recorded, according to J. B. Kincer, in charge of the bureau's work on the relation between weather and crops. None of the bureau's records show such a deficiency of rainfall. Though the cool weather that has now come over the middle west will retard the deterioration of the crops, it will not help materially. What is needed is rain and none is in sight.

As indicating the severity of the drought, Mr. Kincer stated that the preliminary figures for July show that the lower Mississippi Valley had only a fifth of the normal rainfall during the month. The Ohio Valley has had only a third to a half of normal, the southern plains of Texas only a fifth to a quarter and the northern plains a third to a half. During the early part of the year, the rainfall was also much less than normal and this has aggravated the situation.

ITEMS

A NEW riddle may have been created by recent observations of Professor Carl Oppenheimer, of Berlin, and Hermann Junker, of Hamburg. These men have been working with extremely weak solutions of metal salts, of hormones and some of the vitamins. The solutions are so weak that they can not contain any molecules, as their concentration is one part in ten sextillions. Still these extremely weak solutions, which contain an unimaginably tiny amount of a metal salt or a physiological substance, are able to affect the rate of growth of the protozoa.

ENTOMOLOGICAL inspectors in the fruit-fly area in Florida did not find any of the pests during the month of July, according to officers of the U. S. Department of Agriculture. This does not mean, however, that the infestation has been completely stamped out, for a small focus may still exist somewhere in the state, capable of starting the mischief all over again if vigilance is relaxed. For this reason growers are zealously spraying with poison bait sprays even where the fly has not been seen for months. The material for this work is being supplied gratis by the Florida Citrus Growers Clearing House.

THE Mexican fruit fly, cousin to the European fruit fly that has caused much trouble in Florida, is again threatening the citrus areas on the southwestern border of the United States. It has not yet established itself on American soil, but its larvae have been found in a chance lot of plums from localities in Mexico supposed to be outside the "zone of defense" which the Mexican government has thrown about the area where its infestation is chronic. The fly has twice gained temporary footholds in the United States, and only by the most rigorous methods and whole-hearted cooperation by both Mexicans and Americans was the visitation stamped out.

EXPERIMENTS showing a direct connection between the center of optical function and the skin, which is the organ of tactile impressions, have been reported by Professor J. G. Dusser de Barenne, of the University of Utrecht. The experiments also showed the existence of a sense function of the visual organ outside of its optical functions. Till now the thalamus opticus has been regarded as the organ of vision exclusively. The nervous effect caused by direct or reflected light on the eye travels along the optic nerve into the brain where in the thalamus opticus the visual picture is seen. Destruction of this portion of the brain results in incurable blindness, albeit the optical apparatus may be intact. Working on cats, Professor de Barenne injected by means of a specially constructed microinjector a few drops of a weak solution of strychnine sulphate colored with toluidine. The astonishing result of these injections is the development of areas on the skin of extreme sensitiveness to pain and other stimuli. They are most marked on the side of the body opposite to the injected part of the thalamus, and on extremities like the ears.

AN effort to enlist the aid of intelligent amateurs in the preservation of the fast disappearing prehistoric Indian remains in the United States has been launched by the National Research Council, through its committee on state archeological surveys. The great majority of our Indian remains have already been destroyed, according to an account in a guide leaflet for amateur archeologists issued by the council. This destruction is partly due to plowing, road building and city development. The greatest destruction, however, has been wrought by curio hunters who have dug into Indian mounds in search of relics without realizing that they were destroying valuable historical material. The publication explains briefly but specifically the methods of digging and preserving relics approved by archeologists, and shows how the data should be recorded so that the discoveries will be of scientific value.

SCIENCE NEWS

Science Service, Washington, D. C.

THE DISTRIBUTION OF RAIN

AMERICA is not alone in suffering abnormal weather conditions, according to information reaching the U. S. Weather Bureau. In central, south and western Europe drought has threatened the wheat crop, which has been especially hit in Italy. The condition in France is also bad, in Germany it is not so bad, while in England the crops have not yet been affected. Rain has come in England, so that the conditions there will probably be relieved.

In Japan and along the coast of China it has been very wet in recent weeks, with many typhoons. In South America, where the seasons are reversed and it is now the middle of winter, the weather has been unusually cold. Reports from Australia, also now in winter, indicate that the Australian wheat crop is unusually good.

With such abnormal conditions in the United States they are to be expected elsewhere, though not of the same kind, according to Dr. C. L. Mitchell, of the Weather Bureau.

"When it is excessively dry here, it will be excessively wet elsewhere, and when we have unusually hot weather other parts of the world will be unusually cold. In other words, the average over the world stays pretty much the same. Lately there have been a good many rains at sea, and a rain at sea is really a most useless thing!"

There have also been rains lately in the region east of Hudson Bay. This is the center of the main disturbance of eastern North America, and other disturbed regions, or low-pressure areas, have been merely satellites of this large low in Labrador. This condition permits the warm air from the Gulf of Mexico to pass unhindered in a northeasterly direction across the country. A large low over the Middle West with a high to the north of it would produce the conditions needed for rain, he said, as there is moisture in the atmosphere, and it is only necessary to precipitate it. But there are no artificial means of making this happen. Just what has caused this distribution of pressure areas Dr. Mitchell could not say.

Only the drought and hot spell of 1901 can compare with the present one. But that was confined to July, and was over by this time of the year, and this one is still continuing. Certain parts of the country were harder hit in that year than they have been so far this year, but as the present drought threatens to continue for some time it is quite likely that this will prove far worse.

EFFECTS OF THE DROUGHT

THE latest information obtained at the U. S. Department of Agriculture indicates that no danger of actual food shortage is foreseen in the extreme drought affecting crops in wide areas of the United States.

Luckily the major portion of the wheat crop was safely harvested before the effects of the continued heat had begun to tell and this means, at least, an abundance of flour for bread.

The possibility of a potato shortage still looms but is not yet serious. Meat, on the other hand, promises to be cheap. In fact, the fear is that it may be disastrously so for the farmer, as pasture lands are suffering and the prospects for a normal corn crop lessen with each additional dry day.

Two more weeks of drought would mean that thousands of farmers will be forced to kill their stock this winter because they will not have enough feed to last them through until the next crop. Such a forced marketing of stock would have the effect of lowering meat prices and involve serious losses to stock raisers throughout the country. Supplies of wheat already harvested and the additional spring crop that will be garnered from the northern states, if the drought there is not too prolonged, should partially compensate for the corn crop shortage, however.

With the stock-raising industry the worst hit by the drought, a milk shortage might be expected, but thus far the surplus supply of dairy products has sufficed and stood the dairymen in good stead in preventing a price slump. Luckily the dairy communities of Minnesota, Wisconsin and northern Iowa have not been among the worst hit, although this season of the year is normally one of reduced milk production.

Regions bordering around the Ohio-Mississippi river system from Pittsburgh to the Gulf and Montana and adjacent portions of North Dakota are those most affected by the heat wave and three quarters of the average crop yield is the best that can be hoped for from these sections. There is still the possibility of crops above the average from New York, the New England States, and North and South Carolina, while portions of Wisconsin, Iowa, South Dakota and Nebraska may still be above par. But surrounding the area of extreme drought on the borders of the Ohio and Mississippi, there is a large section which will yield slightly less than average crops, probably about four fifths the normal yield.

The picture painted for the whole country is not so black, then, as might be expected, though certainly it does not look bright for many communities. This reckoning is based only on the present crop indications, however, without a calculation of the dire chances involved in continued and wide-spread drought. If there is no relief from the heat, the present picture is too optimistic.

Chances of a hot dry August following a hot dry July are only one in eight, however, judging from the records of past years. While offering this reassurance for what it is worth, the statisticians of the U. S. Bureau of Agriculture left the duty of prophecy to the Weather Bureau, which to date offers no promise of relief.

PATENTS FOR RAIN-MAKING DEVICES

IF you could make rain in any desired amount to order, you would undoubtedly become, to-day, the most

famous person in the world, besides earning a fabulous fortune. The present severe drought has brought its usual crop of professional rain makers seeking to swindle the credulous farmer, who in his present desperate straits is willing to take a chance on almost anything that may bring relief to his sun-baked, withering crops. No method has yet been devised which will produce rain in a sufficient quantity to make it practicable during a severe drought such as we are now having, but unfortunately not all farmers know this.

The professional rain maker is a shrewd salesman who knows how to play on the credulity of human nature. He may, for example, enter into a contract with a farmer promising him rain in a week or ten days for which he is to receive five thousand dollars. The rain maker will then set up some formidable looking apparatus which discharges electric sparks or chemicals in the air. He may explode shells containing gunpowder or nitroglycerine. Under ordinary circumstances rain is bound to come sooner or later, and the rain maker can very well gamble on this chance, for he has nothing to lose. As soon as rain comes he credits the performance to himself and, of course, demands the sum specified in his contract.

Rain makers have been careful to protect their methods and devices by obtaining patents from the government. Daniel Ruggles obtained a patent in 1880 for making rain by sending up one or more balloons carrying explosive cartridges and torpedoes which are detonated by an electric wire trailing on the ground. His theory is that the explosion produces a concussive force which condenses the moisture in the air, thus producing rain. There is actually no scientific basis in this theory. During the war immense quantities of explosives were detonated, but no appreciable quantity of rain was caused by those explosions.

Another patent issued in 1891 to Louis Gathmann first forms rain clouds by spraying liquid carbon dioxide gas high up in the air. The evaporation of the carbon dioxide cools the air, condensing the moisture it contains, forming a cloud and finally rain. This method appears plausible at first, but in order to cool large quantities of air so as to produce any appreciable condensation of moisture, extremely large quantities of liquid carbon dioxide would have to be used, the cost of which would be prohibitive. The rain thus produced would not save enough crops to pay for the expense involved.

Several patents have also been granted for balloons equipped with sharp metallic points in order to discharge electricity in the air. John Potts, for instance, obtained a patent in 1913 for a balloon having many sharp spurs on its surface. These points are attached to a wire which is grounded. Another patent, granted in 1918, uses a similar device. The inventor explains his theory in the following language:

"The atmosphere is known to contain transient zones of electrified air, and it is also known that aqueous particles constituting clouds are invariably charged with electricity and that the potential distribution throughout such atmospheric zones and clouds is usually uneven. It is also known that the sign and the potential gradient of regions of the atmosphere are varied or altered by these charged zones of clouds. I have discovered that if the potential gradient between earth and such atmospheric zones and clouds is diminished or canceled, particularly at times preceding rainfall, or at times when rain is falling, rainfall is procured or stimulated." Unfortunately although this theory sounds plausible it does not work out in practice to produce rain.

Numerous devices, such as those we have just described, are at present being offered to hundreds of farmers to break the drought. The officials of the United States Weather Bureau brand these devices as pure fakes, and the men who are enriching themselves at the farmers' misfortune are nothing but scoundrels.

Science has not yet discovered all the facts of meteorology. We are still at the mercy of the elements, just as our ancestors were thousands of years ago, except that we have provided ourselves with better shelter. Until our knowledge of weather is more complete than it is at present, it will be almost impossible to control or to make rain when we need it, because we do not understand all the underlying causes. Until then, farmers can do nothing in times of drought, in spite of the claims of inventors or professional rain makers.

FISH CROP OF THE CANADIAN PRAIRIES

THE Canadian prairies raise other crops than those of grain. Recent Canadian Government statistics show that more than $4,000,000 was paid last year for fish caught on the prairies.

This new industry has arisen in the three central provinces of Canada, which because of their wheat-growing facility have been called the granary of the British Empire. Commercial fishing is an established industry, reaching north as far as Lake Athabasca. On the shores of this lake, nearly 1,000 miles distant from Winnipeg and some 1,700 miles from Chicago, are factories where whitefish and trout are caught in large numbers to be frozen, packed in special wrappers, boxed and shipped by refrigerator barges down the Athabasca River to Waterways, the end of steel, 200 miles distant to the south.

There are innumerable lakes in the prairie provinces. Each year during the past few years has seen more and more boats of all sorts going northward to the unfished lakes of the region. Fishermen are stationed at these lakes far from the railways and are out daily during the summer season, pulling in their nets and bringing their catch to their station where a boat comes every day from the central station of the fishery company to call for the load. By easy stages the fish is brought to the railways, carried that far by water craft.

In winter the fishing still goes on. A large portion of the annual fishing sales consists of winter-caught fish. Through holes in the ice the fishermen work their nets, and daily they go out to haul in the fish which have thus been captured under the thick ice. Horse-drawn sleighs call once a month during the winter months, making their way over the ice from lake to lake. The sleighs

are loaded with the boxes of frozen fish, which are dressed on the ice, and packed in weather that is usually thirty below zero and often down to fifty below. By sleigh the fish are taken to the railway.

Commercial fisheries are of the opinion that the fish business of the Canadian prairies is still in its infancy. They see a great future for the business with the coming of better transportation facilities. Railways are now being built farther north in the prairie provinces, and they will tap the fish districts, aiding a growing industry which brings whitefish, tullibee, pickerel, grayling, trout and sturgeon to the tables of the prairies and the midwestern states of the United States.

EARLY RECOGNITION OF WHOOPING COUGH

DELAY in quarantine of whooping cough which exacts a death toll twice as large as scarlet fever is deplored by Dr. Louis W. Sauer and Leonora Hambrecht, of Evanston, Illinois, in a report to the American Medical Association, recommending early diagnosis by the cough plate method.

Under the present system of diagnosis, quarantine is not usually established until after the period of greatest contagion has passed, these authorities charge. This is because the familiar whoop does not appear until the illness is well advanced. It is not necessary for the doctor to await this symptom in a suspect case, however, as the pertussis bacillus which causes the whoop can be detected by cough plates or disks which are held three or four inches from the patient's mouth during a coughing spell.

Cough plates are made with a coating of boiled potato, glycerin, agar and blood mixture, prepared under conditions most favorable for the speedy growth and detection of the whooping cough bacillus. To properly expose them for diagnosis, a deep explosive cough is desirable. Should the patient prove unable to cough to order, a drink of cold water, a brisk run or a forceful slap between the shoulder blades is usually effective in bringing on an attack.

Successful trial of the cough-plate method of diagnosis has been made by the Copenhagen Health Department, while in America the Commission for the Study of Whooping Cough has reported favorably on its use.

Importance of the early detection of whooping cough is in the prevention of epidemics. In the treatment of individual cases, however, it is not particularly helpful.

ITEMS

PELLAGRA has increased during the extreme summer drought in practically all the southern states, according to reports received by the U. S. Public Health Service. Spread of the disease is believed to be due more directly to unfavorable economic conditions than to the severe heat and dryness, but indirectly the drought has been an important factor in reducing crops and bringing about the food scarcity that causes pellagra. Exact statistics on the cases of pellagra in the various states are not available, but an increase in cases has been noted in North and South Carolina during the past several months and more recently health workers in Kentucky and Arkansas have reported worse conditions.

FAD diets, modern habits of living, self-prescription and overuse of laxative medicines and mineral oils, and infection, either directly or from foci, are among the possible causes suggested by doctors to explain the sharp rise in the appendicitis mortality rate during the last nineteen years. In 1928, more than 18,000 deaths in the United States were attributed to this cause alone. Reports issued by the Metropolitan Life Insurance Company, based on records of policyholders, show an increase of 20 per cent. in the death rate for white males and a 14 per cent. increase for white females during the last five years of this nineteen-year period as compared with the first five years. More men died from appendicitis during the entire period than did women and apparently they are becoming increasingly susceptible to the disease. During the nineteen years there has been immense improvement in surgical technique and focus of interest by the public and physicians on the disease has insured early diagnosis thereby improving conditions for recovery, but still the fatalities grow.

ITS return heralded by unauthorized press reports that it had unearthed the skeleton of a prehistoric giant race which once inhabited America, and specimens of the silk or linen clothing worn by these ancients, the expedition of the University of Pennsylvania Museum has returned from excavating an old Indian mound near Wheeling, West Virginia. Mr. Charles Bache, leader of the expedition, stated in his report that very important discoveries were made at the mound. The expedition uncovered large spear heads of stone, some more than six inches long, cut into blades by prehistoric Indian warriors. The mound also yielded fine tobacco pipes carved by these Indians of pre-Columbian times. Mr. Bache declared incorrect the advance news reports that these prehistoric men were forerunners of the Indians and occupied America before the red men. He stated that the skeleton in the mound was of normal size. What was reported as fabric was probably fragments of bark wrappings.

RAYON and other synthetic cellulose fabrics will soon be underselling cotton goods as they are now underselling silk. So prophesies Professor Charles E. Mullin, head of the division of textile chemistry at Clemson College. One company, he states, has already announced that it can produce viscose yarn at a lower price than that of medium or fine cotton yarns of the same size. Synthetic fibers are competing with silk not only in price, but also in fineness. It is now possible to produce filaments that are two and one half times finer than those of true silk. These are being made on a commercial scale both in America and abroad. It requires more than 4,225 miles of one of these filaments to weigh a pound.

SCIENCE NEWS

Science Service, Washington, D. C.

THE FIFTH INTERNATIONAL BOTANICAL CONGRESS

AMERICAN leaders in the study of plant life were accorded prominent places in the councils of the Fifth International Botanical Congress, which assembled at Cambridge on August 16. The presidency of the meeting was naturally given to the great university which is acting as host to the world botanists, in the person of Professor A. C. Seward. But the active work of the sessions is carried on in eight sections, and three of the eight section chairmanships have been assigned to American scientists. These are Professor H. C. Cowles, of the University of Chicago, who presides over the section on plant geography and ecology; Professor R. E. Buchanan, of the Iowa State College, at Ames, who has charge of the section on bacteriology, and Professor L. R. Jones, of the University of Wisconsin, whose section deals with questions of plant diseases and the fungi that cause them. There are also three Americans in the list of honorary vice-presidents of the congress: Professor L. H. Bailey, of Cornell University; Professor R. A. Harper, of Columbia University, and Dr. E. D. Merrill, of the New York Botanical Garden. American botanists are turning out in large numbers for this meeting, the first international gathering of its kind since the International Congress of Plant Sciences held at Cornell University, Ithaca, New York, four years ago. The Ithaca congress was the first international botanical meeting of the post-war period. Over three hundred American botanists had signified their intention of attending the present congress.

ACCORDING to advance reports, Professor A. C. Seward, of Cambridge University, president of the congress, told of the difficulties in bridging the gap between the plant forms of the late Paleozoic, when the principal coal beds were formed, and those of the Mesozoic, or age of dinosaurs. World climate, and the face of the earth itself, underwent revolutionary changes during that critical period in geological history, according to Professor Seward, and the great changes in environmental conditions were reflected in the downfall of the earlier dynasties that had ruled the ancient forests and the rise of new and different dominating families. The hereditary steps by which the new arose from the old can not be traced in any fossil records which have yet been discovered. Professor Seward believes that the rocks of inner Asia, which have recently given up many of the early family secrets of the dinosaurs, may also yield some of the missing chapters in the story of plant evolution, once they are searched with sufficient care and understanding by men who can tell when and where there was a forest a hundred thousand years ago by searching for microscopic grains of fossil pollen in the peat of an ancient bog. The yellow fertilizing dust that settled on the waters and was drowned and absorbed into the muck on the bottom is read especially zealously to learn the movements of the great thickets of hazel that marched on the margins of the sub-arctic forests in the days when the glaciers were retreating from the face of Europe. But it is not all plain sailing, this seeing of woods where only the fossil dust of its flowers remains. According to Dr. G. Erdtman, of the University of Alberta, there are difficulties in searching for vanished woods with a microscope. It can not be assumed that where there is much pollen there was a heavy growth of the plants that produced it, and that where there is none there were few or no such plants. If the bog into which the pollen fell was not in proper condition to receive and preserve it, the pollen would be lost and thus no record would remain. Such conditions would include a chemical or bacterial state of the water that would cause the pollen grains to decay, a frozen surface over the bog at the time of pollen-shedding, or one of a number of other circumstances. Therefore one's grain of pollen must sometimes be taken with a grain of salt.

MODERN Denmark is a country of man-made forests. Only about eight per cent. of its territory is wooded, and about two thirds of that fraction consists of evergreens planted by man—wholly artificial forests. The remaining third consists of almost pure stands of beech. These were originally native forests of mixed timber, but due to selective cutting almost nothing but beech is left. The problems of forestry in an almost forestless country were presented by Professor C. H. Ostenfeld, of the University of Copenhagen. Danish foresters do not really like the pure beech forests, for beech trees are exhausting to the soil, and are not such valuable timber as some of the trees they have replaced in the course of the centuries. However, the highly valuable oaks were all cut out many years ago, and the beeches did not permit them, nor any of the other hardwood species that went with them, to develop again. Beeches form a dense shade, beneath which their own seedlings can grow, but not the seedlings of other trees. The shade is so dense, in fact, that very few bushes and herbs will grow in a beech forest. The return of a mixed hardwood forest, of a type resembling the original native woods, is much desired by Danish foresters, but they have to foster it by strictly artificial means.

EVOLUTION through crossing of dissimilar parents, a rival theory to the continuous-variation idea of Darwin and the sudden-mutation mode advocated by DeVries, is upheld by a Dutch botanist, Dr. J. P. Lotsy. He points out that our idea of a species is based on the assumption that all individuals that look very much alike have had a common descent. We see the grandchildren and take the ancestors for granted. Beginning at the other end, he selects ancestor-plants and traces the development of new character-combinations in their descendants. In spite of the plausibility of the mutation theory, he insists that it has never been proved that a

new form of specific rank has arisen in this manner. The only new forms whose origin has been actually observed have been produced by hybridization, though even these are not of specific rank. Dr. Lotsy regards it as quite possible that the main divisions of the organic kingdom originated by hybridization. In many of the lower forms of life, from which the higher ones are assumed to be derived, the cell protoplasm as well as the nuclei unite during the reproductive process. This, Dr. Lotsy states, furnishes a possible mechanism for the development of the major differences that separate the great divisions of the plant and animal kingdoms.

THE stem or leaf of a plant can best be understood if we think of it partly in terms of the engineering principles governing reinforced concrete structures, partly in terms of the principles governing flexing springs. The plant's mechanical problems demand a compromise between these two sets of principles, and the most successful plants are the ones that have evolved the best structural compromises. As a matter of fact, plants have on the whole been more successful as inventors of reinforced structures than have human engineers. These are the central ideas of an address by the Russian plant physiologist, Professor W. Rasdorsky. The classic theory of plant parts as mechanical structures regarded stems and similar parts merely as sets of rigid beams. They are much more like reinforced concrete pillars, the long tough strands, frequently interwoven with each other, representing the reinforcing rods or webs of expanded metal, the pith and small-celled tissues between the strands representing the concrete "fill," and the hard rind taking the place of the "armor" in which reinforced concrete columns are sometimes sheathed. Plants have an advantage over artificial reinforced structures because reinforcing strands and "fill" are grown together, not merely poured and tamped together, so that there is far less danger of cracking or ripping apart. Furthermore, the "fill" of small cells is much more elastic and compressible than is the mass of cement and crushed rock in a concrete pillar, so that there is a certain amount of "give" under a heavy strain, which might cause an overloaded completely rigid structure to buckle and break.

EVEN so minute a living thing as a bacterium parasitic on plants has an internal structure corresponding in a way to the various organs found in larger plants or animals. R. H. Stoughton, of the Rothamsted Experimental Station, England, has found that the germ of one of the serious diseases of the cotton plant, angular leaf-spot, which has been described as "structureless," has quite a number of special features about it that can be seen by sufficiently careful microscopic examination. Most important of the internal structures is a central mass that seems to correspond with the nucleus in the cells of higher organisms. It divides when the bacterium itself is preparing to split into two new individuals, which is one of the most characteristic of nuclear performances. Mr. Stoughton also observed individual bacteria budding off tiny round bodies, which subsequently "germinated" into the rod-like shapes of the parent organisms. Mr. Stoughton also experimented with cultures of the organism to find out under what conditions the disease was most likely to attack cotton plants. He worked with apparatus designed to control air temperature, soil temperature, air humidity and light. With these environmental elements under control, he found that the bacterium likes a temperature of 75 degrees Fahrenheit best, and will not grow if the mercury rises above 94 degrees. If a liquid containing the bacteria is sprayed over the leaves of the cotton plant, infection will occur at all temperatures up to 104 degrees, but there is some evidence that younger leaves are most susceptible at low temperatures and older ones at high.

IF you were a physician, what would you make of a disease germ that changed its trade almost overnight, and thereafter produced some other kind of a disease? That is one of the diagnostic difficulties that plant pathologists are up against as shown by studies by J. Henderson Smith, of the Rothamsted Experimental Station, England. The only way one can be quite sure of his diagnosis of a plant disease caused by a filterable virus is to have a pedigreed culture of the virus and a standardized host plant of known source, age and environment. Under unstandardized conditions, such as one has to deal with in the field, the symptoms of the various virus diseases differ so much as to make identification by inspection alone untrustworthy. Even a difference in the mode of infection may make a considerable difference in the appearance of the disease. The most baffling difficulty encountered in some cases, however, is the tendency of the viruses themselves to change, especially when the disease has been transferred from one plant to another of a different species or variety. These changes in some instances seem to be permanent. The virus diseases with which Mr. Smith has been dealing are caused by organisms (if they are organisms) too small to be seen with even the highest powers of the microscope. Whatever the causal bodies may be, they can pass through the pores of a fine-grained porcelain filter; whence their name, filterable viruses.

BACTERIA that find oxygen a poison and that breathe hydrogen instead have had their physiological secrets investigated by Professor J. W. McLeod, of the University of Leeds School of Medicine. Plants and animals take up oxygen simply as the readiest means of obtaining energy from food substances. These bacteria, which prefer places where there is little or no air, are able to get their needed energy by a different process. They detach hydrogen from certain complex organic compounds, and the breaking apart of these molecules releases energy. Oxygen is inimical to this process. If the newly released hydrogen comes into contact with oxygen the two elements unite to form hydrogen peroxide. Bacteria that can live in the presence of a very little air can tolerate a certain low concentration of hydrogen peroxide, but those that demand surroundings

where there is no oxygen at all apparently find themselves paralyzed if hydrogen peroxide is generated even in small quantities. A curious fact about these oxygen-hating bacteria is that they are quite lacking in one of the enzymes or organic ferments, catalase. This particular enzyme was once thought to be absolutely indispensable to any kind of life.

THE root bacteria of clover, alfalfa and other legumes, that befriend the plants and through them man and his domestic animals, come at the outset as though they were enemies. They invade the delicate, thin-walled root-hairs in just about the same way as disease germs, and cause them to curl up as though they were sick. These are among the things that were seen by Dr. H. G. Thornton, of the Rothamsted Experimental Station, England, and Dr. E. F. McCoy, of the University of Wisconsin. Not all the roots of a susceptible plant can be invaded by the bacteria. Alfalfa seedlings were suspended with their roots in a thick "soup" of nodule bacteria; yet only about four per cent. of the root-hairs received bacterial guests. Moreover, the plants seemed to have a considerable degree of resistance to such invasion during their infancy, for no bacteria found their way through the walls of the root-hairs until the seedlings had put forth their first true leaves. This would seem to indicate that a secretion of the roots was active, either in discouraging the bacteria before the leaves appeared, or in encouraging them when the proper time arrived.

WHATEVER believers in the permanence and unchangeability of species may have to say about higher plants, they must speak softly when they deal with the lowly moulds. Evolution while you wait seems to be the order of the day with some of them. Dr. William B. Brierly, of the Rothamsted Experimental Station, has worked with cultures of *Botrytis cinerea,* a common fungus found on grapes. This organism simply will not "stay put," he has discovered. Starting with a single spore, to make sure he had as uniform a stock as could be secured by any known method, he found that the offspring organism varies constantly. Some of the variations were discontinuous, some progressed continuously. He could induce a continuous modification at will by varying the culture medium and return it to the original type by restoring original environmental conditions. But some of the discontinuous variants refused to revert to type even under prolonged selection.

SULFUR has a blighting and fatal effect on some of the fungi responsible for plant diseases. But to do its work a particle of the solid sulfur itself must come into contact with the thread-like body of the fungus. This has been discovered by Dr. William Goodwin, of South Eastern Agricultural College, Wye, England. His work was designed to settle the disputed question whether sulfur volatilized by heating could also kill fungi; he found that it could not. He also found that the effectiveness of powdered sulfur in washes and sprays is heightened by the presence of an alkali.

LIVING plant cells can be induced to absorb dyestuffs, making their usually invisible workings possible of examination with the microscope, according to Professor Hans Pfeiffer, of Bremen. Professor Pfeiffer sometimes encountered difficulties in getting living protoplasm to take up coloring matter rapidly enough, or evenly enough, or without damage to itself. He also planned to present a paper on the persistence in mature stems of cells that are essentially in a state of permanent infancy.

BOTANIZING through the forests of about a quarter of a billion years ago and comparing their floras as one would compare plants gathered only yesterday, Professor Dr. W. Gothan, curator of the Prussian Geological Institute, Berlin, has found notable similarities between the plants of England, of Schleswig in Germany, and of parts of Asia Minor. Plants of the same periods from remoter parts of the world, he found, were different from each other, just as plants from the far ends of the earth to-day are dissimilar. The differences are frequently so great that it is difficult to judge whether they were alive at approximately the same time. Nevertheless, one of his German colleagues has been able to find instructive parallels between fossil plants from Shansi province in China and others discovered by Dr. David White, of the U. S. Geological Survey, in the Grand Canyon of Arizona.

EVERY treetop lives in a desert, exposed to hot sun and drying wind; it is, moreover, farthest removed from the base of water supplies. It responds to these desert conditions by becoming more or less like a desert plant, Professor Bruno Huber, of the University of Freiburg, has discovered. An examination of leaves and stems from the tops of trees showed anatomical differences according to their location in sun or shade. "Shade leaves" were more like those on the parts of the tree closer to the ground and better sheltered from evaporation; "sun leaves" were protected in various ways from the drying effects of the air. Sometimes they worked to keep down the rate of evaporation by means of thicker skins, smaller cells, tinier breathing-pores or stomata, etc., and sometimes they yielded to the air's demand for water but had better facilities for renewing the supply from beneath. Professor Huber calls attention to the fact that plants of both types can sometimes be found growing side by side in places where the evaporation rate is high.

DR. H. S. THORNTON, of the Rothamsted Experimental Station, has found that entirely new types, in either shape or size, will appear in a culture of bacteria. They persist even when they are subcultured for many generations. They seem to be genuine cases of the evolution of new varieties taking place before our eyes. Dr. Thornton warned, however, against regarding as genuine new types strangers that have wandered into the culture. As against the old doctrine that bacteria reproduced only by breaking into two even halves, Dr. Thornton supports the new evidence that sometimes they bud off smaller pieces, which then grow up into full-sized bacteria.

SCIENCE NEWS

Science Service, Washington, D. C.

HALLEY'S COMET

THAT Halley's comet had two distinct tails which appeared as one when viewed from the earth is the recent conclusion of a University of California astronomer. Although the famous comet is known to have visited the earth every 75 years for as long a time as records have existed, its peculiar characteristics had not been thoroughly studied until the present work.

The investigation has been made by Dr. N. T. Bobrovnikoff, national research fellow in physics, and will soon be reported in a Lick Observatory publication. It is based on more than 700 photographs of Halley's comet, made at Lick and other observatories in 1910, and has consumed three years of intensive study.

One of the comet's appendages was a straight, narrow streamer of deadly carbon monoxide gas, according to Dr. Bobrovnikoff, while the other of meteoric dust was more diffuse, not so bright and considerably more curved.

By tracing the motion of gaseous and dust condensations outward from the head of the comet along the tail, Dr. Bobrovnikoff has been able to determine the law of force motivating these formations. The condensations are ejected from the head of the comet by internal explosions similar to volcanic eruptions on the earth, or the flaming prominences on the surface of the sun.

As soon as they are free from the head of the comet, the knots of volcanic matter move outward along the tail driven by a mysterious unknown force which outweighs the opposing gravitational attraction of the sun.

What this force is no one can say definitely at present. It may be due to radiation pressure from the sunlight, or to the effect of the sun's electrostatic field, or to a combination of the two. Whatever its source, its activity can be determined by studying the hyperbolic motion of the jets on successive photographs.

Dr. Bobrovnikoff has found that the moving particles in the curved tail obey a repulsive force less than one half that of solar gravitation, while the forces in the carbon monoxide tail attain values up to several hundred times the sun's attraction.

The presence of dark, invisible formations at much lower temperature was also detected, from their effects on the neighboring jets and streamers.

From the behavior of the jets near the head of the comet, Dr. Bobrovnikoff found it necessary to introduce a new unknown factor in his calculations, the repulsive force of the comet's head. He obtained a value for the mass of the head amounting to one ten billionth the mass of the earth.

The predominance of violet light in the comet's luminosity he interpreted as due to fluorescence or excitation of the cyanogen and other molecules by sunlight.

ECLIPSE PREDICTIONS BY THE MAYAS

HIGHLY accurate predictions of eclipses of the sun and the moon were made by the Maya Indians of Central America at least eight centuries before Christ, according to Dr. Herbert J. Spinden, curator of ethnology of the Brooklyn Museum. But after the Mayas predicted an eclipse, they did their best to stop it by magical means. When occasionally their predictions failed and the eclipse did not occur, they attributed this to the success of their magic.

Dr. Spinden is now on his way to Europe where he will attend the meeting of the Twenty-fourth International Congress of Americanists at Hamburg, and will give a detailed report of his discoveries, which show a surprisingly extensive astronomical knowledge among these early Americans.

Before his departure he explained to *Science Service* that the Mayas, after observing and counting the days between eclipses occurring over a period of a century or more, discovered how eclipses repeat after a certain period. In 752 B. C., on November 10, according to our present calendar, there was an eclipse visible from their capital city. These studies gave them the knowledge to predict, and they worked out a period of 260 days, each with a separate name, which in multiples made a table by which eclipses could be foretold. But eclipses, especially of the sun, were supposed to be forebodings of evil and so they tried to stop them when they found that they were due.

The Mayas were at the height of their temple-building civilization during the first six centuries of our era and in their inscriptions on these temples they frequently noted eclipse days. Their hieroglyphic symbols were very expressive, for a sun eclipse was represented by their sign for the sun combined with the sign representing darkness, so that the symbol literally means "sun-darkness." Moon eclipses were represented by the moon face with a band as if it had a toothache and wore a bandage. Dr. Spinden thinks that the idea intended was that the days of the moon were finished and that it was tied up ready for burial.

DUST EXPLOSIONS

ALMOST all kinds of dust, even powdered metals, like aluminum or iron, are explosive when floating in the air, so the explosion that wrecked a grain elevator in Baltimore recently was not a very unusual occurrence. It was due to grain dust, floating in the air, and might have been started by an electric spark, though the cause can not definitely be stated at present and perhaps never will be ascertained.

The chemical engineering division of the U. S. Department of Agriculture is investigating the explosion, under the direction of David J. Price, in charge of the division, assisted by H. R. Brown and B. J. Culp.

Speaking to *Science Service* before the investigation, Mr. Price expressed surprise that the explosion occurred in the Western Maryland elevator, however. He said that it was a modern plant, of reinforced concrete con-

struction, with modern machinery and was well managed. In fact it was considered one of the best elevators in the country. In view of this fact, he thinks that the explosion may have been caused in some way that his investigations have never before encountered.

Though a pile of dust will not burn if a match is touched to it, and the match may even be extinguished, this is only because the grain does not have a supply of oxygen to keep it burning. When the same dust is floating in the air, each single grain has a supply of oxygen in the air around it. The result is that when it starts it burns so rapidly as to make a real explosion.

PREVENTION OF LEPROSY INFECTION BY VITAMINS

HOPE that one of the world's oldest and most loathsome scourges may be conquered is contained in reports from Japan that Dr. K. Shiga, bacteriologist and dean of the medical faculty at Seoul, Korea, has discovered that vitamins in sufficient amounts will prevent infection of animals, and presumably man, with leprosy.

Although the leprosy bacillus was discovered in leprous sores of persons afflicted with the disease more than fifty years ago, it has hitherto not been possible to transmit leprosy to lower animals by inoculation. A solitary case of experimental transfer of the disease from man to man, from a leper to a condemned criminal in the Sandwich Islands, was not regarded as convincing evidence, because the convict had other opportunities of contracting the disease. After many futile attempts to reproduce leprosy experimentally, it has been assumed that a special individual susceptibility to the disease is requisite for its production.

This old assumption of the necessity of individual susceptibility to leprosy is now verified by Dr. Shiga. When he injected leprosy bacilli taken from human leprous sores into normal, healthy rats, the animals remained normal and showed no signs of the disease. They were not "susceptible" to leprosy. Later, however, after the food of the animals had been deprived of vitamins, they soon developed leprous sores and became victims of the disease. They became "susceptible."

If such a simple dietary deficiency accounts for animal or human susceptibility to leprosy, then it will be possible to protect people from leprosy by merely watching their bill of fare and perhaps even to cure lepers by adding vitamins to their food.

PARALYSIS AND VITAMIN B

IS the type of paralysis that afflicts the person who has pernicious anemia caused by an absence in his diet of vitamin B? During the course of experiments designed to disclose the answer to this question, it was found that lack of vitamin B in the diet does cause paralysis of animals. Drs. Edwin F. Gildea, Egon E. Kattwinkel and William B. Castle, working at the Boston City Hospital and the Harvard Medical School, made the discovery. Some time ago it was observed that a diet lacking in this water-soluble vitamin caused neuritis in animals.

In the recent experiment, six dogs were fed the diet deficient in the antineuritic portion of the vitamin B extract. The dogs were given this diet until symptoms of a paralysis appeared and then they were given a full rich diet containing vitamin B and they immediately got better. Then vitamin B was again removed from the diet and the experiments were repeated several times in the same dogs.

After a while the dogs showed spastic paralysis, very similar to the one which human beings develop after they have pernicious anemia. The pathological examination of the sections of the spinal cord showed that the animals had approximately the same type of involvement of the spinal cord as that found in pernicious anemia.

Apparently a definite relationship exists between a diet poor in vitamin B and the occurrence of a spastic paralysis. What takes place in pernicious anemia is involvement of the spinal cord, either due to poor diet or to the fact that the stomach lacks hydrochloric acid which is necessary to digest and absorb the necessary vitamins.

BATHS OF EFFERVESCING WATER

THE beneficial baths of a famous German watering place may now be had in the home by means of a simple apparatus called a bubble or foam distributor. The method of using this apparatus and its advantages were reported to the *Lancet*, an English medical journal, by L. Shillito, of the electrotherapy department of St. Thomas's Hospital.

The natural baths, of warm effervescing water, have been very successful in the treatment of heart disease. Because of the expense of the visit to Nauheim, however, many have been deprived of the help the baths give. With the new device the patient may have them in his own bathtub at home.

The main physiological effects of the baths are due to the temperature of the water and to the carbon dioxide it contains. This gas has an effect on the blood circulation. The carbon dioxide bath is said to be the only physical method of treatment in which the heart muscle is trained without at the same time increasing the pulse rate.

"By a gradual increase of the carbon dioxide content and a reduction of the temperature of the bath, the heart can gradually be forced to do more work, and through this increasing exercise its musculature becomes strengthened, the tone increased and reserve power augmented. The sensation of warmth produced by the strong circulatory reaction allows a lower temperature to be tolerated without shivering," Mr. Shillito said.

The health continues to improve for some months after a course of these baths. This is probably due to a slow and gradual process of repair in degenerated organs which have for the first time, possibly in years, been provided with a more healthy circulation of blood.

FORAGE FOR DINOSAURS

THE strange plant life that the dinosaurs browsed on, as the modern cattle browse on clover or grass, was de-

scribed to the Fifth International Botanical Congress by Professor A. C. Seward, of Cambridge University, president of the congress, and Professor T. G. Halle, of Stockholm.

The transition between the last of the Paleozoic floras, which reached their height during the Coal Age, and the earliest of the Mesozoic plants, which the ancestors of the dinosaurs knew, has always been a difficult and puzzling thing to students of ancient plant life. The world evidently fell upon hard times during the Permian, which followed the Coal Age. There are evidences of extensive deserts and a much modified and often impoverished plant life in many parts of the world. A great part of the rich Coal Age flora simply vanished.

When the first of the Mesozoic plants came in, they already had a rather modern look, and by the time the height of the Mesozoic had arrived and the dinosaurs were at their best, there were plenty of trees that a present-day boy scout could identify as at least the second cousins of the trees he finds in the woods when he goes out camping. Plants far outstripped animals in the evolutionary race; modern animals did not begin to arrive until millions of years later.

It is not yet known why this apparently sudden development of plants took place and where the still missing transition fossils may be sought. Professor Seward suggested that the most likely place to find them would be in the interior of Asia, which has already yielded parts of the early history of the dinosaurs to American expeditions.

PRUSSIAN BIRD AND WILD-FLOWER LAWS

NEW and uniform protective laws for birds and wild flowers have been enacted by Prussia, revising and replacing the old codes that obtained in the various provinces of the state, which were frequently at variance with each other. The new laws specify what game birds may be hunted and when, they list thirteen "outlaw" species that may be killed without restriction at any time and they give all the rest of the bird population the benefit of an absolute closed season.

During the proper open seasons the following birds may now be hunted in Prussia: wild ducks, wild geese, osprey, most of the quail family, sandpiper, curlew, snipe, gulls, terns and pigeons. Outlaw birds include several hawk species, all crows, sparrows, grebes and herons. Certain birds, like ospreys and kingfishers, that are protected generally may still be shot if necessary for the protection of fish ponds.

There will be no more bounties paid for the destruction of predaceous birds. Bird lime and traps or other devices for catching or injuring birds must not be used, and birds must not be hunted with the aid of artificial lights.

Certain wild animals that destroy birds, but also prey on troublesome rodents to an even greater extent, are given absolute protection. Notable among these are wildcat, pine marten, mink and dormouse.

The new list of prohibited plants contains thirty names, mostly of species which have been subjected to destructive collecting by dealers. In some cases very common and popular wild flowers, such as lily-of-the-valley, snowdrop and hepatica, may be gathered for bouquets, but their roots or bulbs must not be disturbed.

ITEMS

SPAIN has become a recruit to the ranks of nations developing national park systems, an idea which was initiated in the New World with the founding of Yellowstone National Park in 1872. Spain now has two national parks and three areas designated as "reserves of national interest." One of the parks is in northern Spain, and the other in the northeast, deep in the Pyrenees. Both are in exceedingly rugged territory, where there are still many wild animals—chamoix, bear, wild boar, deer, etc. In the Pyrenees park there is one deep defile that leads out toward the famous last stand of the medieval hero Roland, who lost his life in a rearguard action protecting Charlemagne's army and gained immortal fame in a thousand legends.

ACETALDEHYDE vapor may have a future use in the preservation of fruit because it kills the spores of molds without injuring the fruit itself. This conclusion has been reached by two investigators who have worked on different sides of the question. Mr. R. G. Tompkins, of the Low Temperature Station, Cambridge, has shown that acetaldehyde vapor rapidly kills the spores of the molds and fungi which are likely to cause fruit spoilage. In the same laboratory, Mr. S. A. Trout has recently found that healthy fruits can absorb a certain amount of acetaldehyde vapor without any harmful effects. The acetaldehyde is used up by the tissues of the fruit and soon disappears, leaving no trace of flavor. The possibility of applying this work to the fruit industry is under investigation.

EXPERIMENTS in the manufacture of dyes from fat have been conducted by Rajendra N. Sen and Ashutosh Mukherji, in the chemical laboratory of the Presidency College, Calcutta. From castor oil was obtained a brown powder, which gave an orange tint to wool and silk. Cocoanut oil was also tried and yielded a brighter orange color, while olive oil made a brown dye for wools and stained silks in various shades of red. The method used in the manufacture of the new dye was developed by Mr. Sen. It consists in using esters of benzoic, salicylic and other acids instead of the acids themselves in the process. Chemically, fats are also esters, although they are quite different from the simpler esters of benzoic and salicylic acids.

INVESTIGATIONS by the bureau of plant industry of the U. S. Department of Agriculture show that a small amount of iodine added to the soil produces a better growth of tobacco and an improvement in its quality. But if the desirable quantity is exceeded the effects are injurious, manifesting themselves especially in abnormal thickening of the leaf, off colors, poor keeping qualities and unsatisfactory burning.

SCIENCE NEWS

Science Service, Washington, D. C.

THE AMERICAN ASTRONOMICAL SOCIETY

THE American Astronomical Society, whose membership of over four hundred includes practically every professional astronomer in the United States and Canada, held a unique session when their annual summer meeting opened in Chicago on September 3. This meeting was held at the Adler Planetarium and Astronomical Museum, which recently opened on a small island just off shore in Lake Michigan and near the Field Museum, Soldiers' Field and the new Shedd Aquarium.

One session of the meeting was held in the planetarium dome, with projected images accurately and realistically reproducing the skies above their head. But the familiar motions of the sun, moon and planets among the stars were shown to the astronomers far more rapidly than they are ever observed in nature. In seven seconds they saw the planets go through their normal motions of a year. Even the "great year" of 26,000 ordinary ones, during which the Southern Cross and other southern constellations become visible from northern countries, was reproduced in a few minutes.

The planetarium instrument that makes this possible is a German invention that projects on a white dome 80 feet in diameter all the naked-eye celestial objects and reproduces their motions. The one in Adler Museum is the first to be erected in the United States, and the meeting was the first opportunity most of the American astronomers have had to see it in operation.

In addition to the demonstration of the planetarium, which was arranged by the director of the museum, Professor Philip Fox, there were five sessions for scientific papers, at which many of the astronomers told of their latest researches. Dr. C. G. Abbot, secretary of the Smithsonian Institution, discussed "Solar Variation and Weather." Other papers were presented on the recent eclipse of the sun in California, measurements of the ultraviolet light from the sun, the absorption of light in space as it travels from a star to us and observations to be made of the tiny planet Eros, which will make a very close approach to the earth during the coming winter.

The discovery by Dr. C. G. Abbot, secretary of the Smithsonian Institution, that there is a close correspondence between changes in the sun's radiation and in temperature at Washington, D. C., "seems to offer promise for weather forecasting nearly a week in advance." Dr. Abbot made the first announcement of these new results which are based on studies extending over a period of more than thirty years.

Regular observations of the sun's radiation are made from a station at Mount Montezuma, Chile, a mountain 9,000 feet high in the Atacama desert, and these show that the sun does not always radiate the same amount of heat. Instead, it varies from day to day, even after allowances are made for the effect of the earth's atmosphere. In a study of these variations since January, 1924, Dr. Abbot has found 98 cases of rapid increase of the radiation of heat and 91 of decrease, in each case the change taking about four or five days.

Dr. Abbot has studied the temperature variations at Washington at the times of each of these increases and decreases. Taking the temperature just before the beginning of the solar change as normal, he finds that as the solar radiation varies the temperature also changes, and that the change in temperature continues until at least four days after the maximum or minimum of radiation. A change in the radiation of eight tenths of a per cent. is accompanied by a temperature change of about five degrees. At times when increase of radiation is accompanied by an increase in temperature, a decrease of radiation is generally accompanied by a decrease in temperature. This is taken by Dr. Abbot as rather conclusive proof that the changes are not mere coincidences.

A curious feature of the results is that an increase of radiation is not always accompanied by an increase in temperature, or vice versa. From mid-November to March, and also in May, increase in temperature and radiation ordinarily go together, while in April and from June to mid-November, the temperature goes down when the radiation goes up. This leads Dr. Abbot to believe that the effect of the sun's heat is not a direct one on the earth, but that there is some intermediate atmospheric effect not yet understood. Even in March and other months when temperature and radiation follow each other most closely, there are isolated occasions when the reverse happens. These, Dr. Abbot thinks, are the chief difficulties in the way of weather prediction from solar radiation. But he explains them as being "doubtless caused frequently by one solar change treading too quickly on the heels of another. Again, they may sometimes be caused by delayed receipt from distant centers of action of waves of temperature effect arising from former solar changes."

The changes in temperature are not the same for different places. Though his most detailed studies are for Washington temperatures, Dr. Abbot has also studied the effects in Yuma, Arizona, and Williston, North Dakota. He finds that there the magnitudes and tendencies of the effects are much the same as at Washington, though the months during which there is a direct change and those during which it is reversed are different.

"My results thus far are tentative," he concluded his paper. "I propose to study barometric pressures as well as temperatures, and to extend the investigation to other parts of the United States and of the world. I have made preliminary studies, too, of ten-day mean values of solar radiation and temperature, and hope that in this way if reliable weather forecasting data are really secured they may be extended to months and seasons in advance."

Why do some stars seem "the other side of nowhere"? Or, as the astronomers express it, why do stars have negative parallaxes? Dr. Oliver J. Lee, of the Dearborn Observatory at Northwestern University, discussed some reasons for this paradoxical effect.

Astronomers measure the distance of nearer stars by determining their parallax. This is the amount that a star seems to shift in the sky as observed at times six

months apart. During this time the earth makes half of a revolution in its orbit, and in June, for instance, is about 186 million miles away from its position in December. By making photographs through large telescopes at these times, and measuring the position of a star as compared with other stars on the same plate but at such great distances that they show no appreciable displacement, the parallax can be measured, and the star's distance determined.

The farther away a star is, the smaller the parallax, so that a star at infinite distance should have a parallax of zero. However, despite the most careful work of astronomers, some stars do actually come out with negative parallaxes, that is, less than zero. It has been facetiously suggested that they are "the other side of nowhere."

Dr. Lee called attention to three reasons why they should occur. In the first place, he said, it may be a matter of chance. Parallaxes are always very small quantities, and like any measurement are subject to a certain possible error, which may be in one direction or the other. If the possible error is larger than the quantity measured, it may throw the value determined under zero. Another reason is that double stars, consisting of two separate bodies, might act differently at different times in building up the image. Under certain atmospheric conditions the image might be principally of one, while other plates might show mainly the other star, thus introducing a shift not due to the earth's revolution.

The third cause suggested by Dr. Lee is that the comparison stars, presumed to be much farther than the star under measurement, are really nearer, and that under such circumstances, the measure would be a positive parallax of the comparison stars. He urged a study of negative parallaxes with a view to learning more about the distances of the stars with which they were compared.

Our galactic system of stars, which includes all that we can see, may be considerably smaller than was previously supposed. Some of the most distant objects in this system may be distant tens of thousands of light years, instead of hundreds of thousands. Even the former figure means distances of hundreds of quadrillions of miles, inconceivably great.

Dr. Piet van de Kamp, astronomer of Dutch birth now at the Leander McCormick Observatory of the University of Virginia, told of his researches on the absorption of light in space. It used to be assumed that all that was in the sky was what could be seen or photographed, with either small or large telescopes. Once a ray of light left a star, and started in our direction, it was supposed that it traveled right on without interference, as there was nothing between to stop it.

This assumption was called into question, however, because luminosity and hence visibility is not a necessary attribute of celestial matter. Meteors are continually bombarding the earth and they are dark and invisible until they are heated to incandescence by the friction with the earth's atmosphere. Huge dark areas have been observed in many parts of the sky, and are almost certainly due to dark masses blotting out the bright material beyond. In addition, space may be full of fine cosmic dust that would absorb light something like a cloud of smoke.

The light of a series of objects at different distances varies according to the famous inverse square law, that is, the brightness is inversely proportional to the square of the distances. Therefore a light which appears to be of a brightness of one candlepower at four meters would appear only one quarter as bright at a distance of eight meters, and not one half as bright. The light would vary in the proportion of sixteen to sixty-four and not of four to eight. But if you observed the two lights at different distances in a corridor filled with smoke, the farther one would be fainter than you would expect from the inverse square law, because the longer path over which the light traveled would cause more of it to be absorbed.

If two lights at different distances are known to be of the same actual brightness, an estimate could be made of their relative distance by estimating how much fainter the more distant one is. But if there is smoke between, then the distant light will seem fainter than it should, and so its distance will be over-estimated.

This principle is used by astronomers to measure the distance of far away stars. Nearer ones can be measured by the displacement they seem to undergo as they are observed from opposite sides of the earth's orbit, 186,000,000 miles apart. But there are various ways of determining the actual brightness, or candlepower, of a star, such as a measurement of the intensity of certain of the dark lines in its spectrum. Such measures have been used as the basis for distance determinations of very distant stars. Direct photographs have shown how bright they appear, the spectrum shows how bright they really are and the difference has been interpreted as being due to the distance. But if there is absorbing matter in space, then the star would appear fainter than it ought, while the absolute brightness would be the same, and the distance so determined would be too large.

In recent work at the Lick Observatory of the University of California, Dr. R. J. Trumpler has found good evidence that there actually is some absorption in interstellar space. He has studied some of the open star clusters and, by assuming that clusters of the same constitution have approximately the same linear dimensions, he concludes that within our Milky Way system light is absorbed at the rate of .67 of a magnitude in 1,000 parsecs. The parsec is the astronomer's measuring stick, and is equal to 206,265 times the distance from the earth to the sun, or 19,200,000,000,000 miles. Another way of expressing the absorption calculated by Dr. Trumpler would be to say that 39 per cent. of the light is absorbed every time it travels a thousand parsecs.

This rate of absorption refers to the light that affects a photographic plate, the shorter waves of the blue and ultraviolet. The longer waves of yellow light that we mostly see by are only absorbed about half as much. But measures of star magnitudes, used in determining distances, are mainly by photography, so the higher figure is the one to be considered. He also found that the absorption takes place mainly in the region of the Milky Way. Our system of stars is approximately the shape of a grindstone and we are somewhere near the center.

When we look towards the edge of the grindstone we look through a much greater depth of stars than when we look to the sides. This concentration of stars to the edge causes the appearance of the Milky Way. The fact that the absorption takes place mainly in this region suggests that the absorbing stuff is distributed in the form of a thin sheet through the middle of the grindstone.

Dr. van de Kamp, who has been working on the same problem independently, confirms Dr. Trumpler's results. He has studied a number of stars of spectral types B and A, which are bluish in color. But he finds that the farther away they are, the less bluish they appear. As there is no reason to suppose that the color of their light actually varies, depending on how far they are away from us, he concludes that their light is absorbed in its passage, and that the blue light is absorbed more rapidly than the red, or longer waves. He believes also that the absorbing stuff is concentrated in a thin sheet in the plane of the Milky Way, and agrees with Dr. Trumpler that it is probably about 175 parsecs in thickness.

Dr. Harlow Shapley, director of the Harvard College Observatory, in a study made a few years ago of nebulae which are completely outside our galactic system, came to the conclusion that their light was not absorbed appreciably. Evidently space outside our system is quite transparent. As none of these nebulae is observed in the direction of the Milky Way, the absorption of their light after it reaches our system would be negligible. Hence the vast distances determined for these objects, tens of millions of parsecs, are still apparently valid. But the distance of stars in our own system and in the direction of the Milky Way may have to be modified considerably. Dr. van de Kamp estimates that stars really only 5,000 or 10,000 parsecs away, for example, would seem to be at 23,000 and 220,000 parsecs, respectively, when no allowance is made for absorption.

In his report to the Astronomical Society, Dr. van de Kamp did not make any suggestions as to the nature of the absorbing stuff. Dr. Trumpler, however, recently suggested that in addition to fine cosmic dust and large meteors, it might consist of free electrons or pieces of atoms that have become ionized and had some of their electrons removed, and free atoms of calcium, sodium and other elements. There is other evidence for highly rarefied clouds of calcium floating around between the stars.

The question as to why ultraviolet light from the sun failed to vary with the number of sun spots during the year from June, 1928, to June, 1929, was discussed by Dr. Edison Pettit, of the Mt. Wilson Observatory, who told of his researches on the variation of the sun's ultraviolet radiation since May, 1924. When three-month averages of the number of sun spots are plotted against the intensity of the ultraviolet light during the past six years, they are found to agree very closely, except during the year mentioned, when the curves run counter. Dr. Pettit believes that there was nothing wrong with his instruments to produce this effect.

He has also found, he announced, that in June, 1924, the ultraviolet radiation was less than during any month since then. Taking the average for that month as the unit, he finds that the highest intensity was during the month of November, 1925, when it was 1.57. In February and April, 1927, it was 1.51 and last January 1.52. The lowest monthly averages have been January, 1928, with 1.18; September, 1928, with 1.12; June and November, 1929, with 1.19, and April, 1930, with 1.15. The ultraviolet rays from the sun are the ones that produce sunburn, are mainly concerned in taking photographs, and produce certain other bodily effects, such as the prevention of the disease rickets.

Dr. Pettit's method is to observe the sun through lenses of quartz, as glass is opaque to the ultraviolet rays. He uses two lenses, one covered with a thin film of silver, the other with a similar film of gold. The former is transparent to the ultraviolet, while the latter is opaque, but transmits visible light of a green color. By means of a vacuum thermocouple, which converts radiant energy into an electric current, he measures the intensity of the sun image as made by each lens. The green light remains relatively constant, so the difference is due to the change in ultraviolet.

Though he has used the same lenses and films of silver and gold ever since he began the measurements, he finds that their constant exposure to sunlight has not made them more or less transparent.

The total eclipse of the sun visible in California last April 28 was 1.7 seconds early, according to Dr. Edison Pettit, of Mt. Wilson Observatory, who described the determination of the time that he and his colleague, Dr. Seth B. Nicholson, made from a talking movie news reel.

The movies were made from Honey Lake, California, where the Mt. Wilson party was stationed. They were made at the rate of twenty-four pictures a second, and in the sound track along the side of the film were recorded Dr. Pettit's counts of the time. From the film Drs. Pettit and Nicholson have found that the middle of the eclipse occurred at 19 hours 5 minutes 51.4 seconds, Greenwich civil time, which is five hours ahead of eastern standard time. The predicted time for the Mt. Wilson station, allowing for their 4,000 foot altitude, was 19 hours, 5 minutes, 53.1 seconds.

ITEMS

INJECTIONS of extracts of the anterior pituitary, a small gland located beneath the brain, cause a marked increase in milk production in cows and goats. This extremely practical discovery was announced to members of the Second International Congress for Sex Research meeting in London by Dr. F. Greuter, a Swiss student of the endocrine glands. The hormones of the anterior pituitary gland control several phases of sexual activity. Dr. Grueter's discovery added another hormone to the list of the anterior pituitary's products. He concludes that this hormone stimulates milk secretion, but is only effective when the milk gland has, under the influence of one of the sex glands, already reached a certain stage of activity. It increases rather than initiates milk secretion. Since the effect of the hormone is most marked and prolonged in cows, it is expected that the dairy industry will certainly try to utilize it. Besides the anterior pituitary, another endocrine gland, the thyroid, appears to have an effect on milk production. The surgical removal of this gland causes a fall in the yield and composition of milk and a change in color.

SCIENCE NEWS

Science Service, Washington, D. C.

THE MEDICAL USE OF MUSTARD GAS

MUSTARD gas, dreaded weapon of the world war, has been reported as possibly preventing and curing a number of diseases. The latest peace-time development of this gas is the announcement by the British Empire cancer campaign that it may prevent cancer in areas of the skin which have been painted with tars that ordinarily produce cancers. This does not in any way mean that mustard gas will cure cancer. Even its preventive action is extremely limited. But recent investigations may lead to a more general preventive method.

The starting point for the experiments leading to this discovery may have been the reported British observation that none of the British soldiers who were exposed to mustard gas in the war ever developed cancer. German experiments along similar lines have also been reported. Previously mustard gas had been heralded as a cure for locomotor ataxia, and other war gases were tried as cures for colds, tuberculosis and various respiratory diseases.

Mustard gas is a sulfur compound, dichlordiethyl sulfide. Recently Dr. Frederick S. Hammett, of Philadelphia, suggested that control of cancer might be gained by means of another sort of sulfur compound. He did not claim to have found any cure for the disease. However, he did state that transplantable tumorous growths in mice had been made to diminish and in at least one case to disappear altogether by the application of an organic compound containing partially oxidized sulfur.

PLANTS POISONOUS TO INSECTS

POISONING the water to catch fish is illegal in almost all civilized countries, as well as in many of the lands of the sun that have become the "white man's burden"; yet the leading governments of the world are now engaged in a zealous search for the most efficacious of the plants used as fish poisons by savage peoples. In a bulletin of the Royal Botanic Gardens at Kew, F. N. Howes, the well-known British botanist, summarizes the knowledge so far obtained. These fish-poisoning plants are desired not for poisoning fish, but for fighting insect pests. The artless savage takes insects for granted, but the more advanced nations of Europe, Asia and the Americas, dependent for their food on the highest efficiency of agriculture, fight the devouring hordes with every weapon at their command. A chief dependence has been arsenical sprays. These are very effective, but some insect pests have developed resistant strains that swallow considerable quantities of arsenic without suffering harm. Hence the search for new kinds of poisons. Fish poisons made from plants have been found highly efficient substitutes. Dilutions of one part in a million or more of water are fatal to insects, usually on mere contact. Derris, an East Indian plant, or rather group of plants, is already in considerable use. It is proposed to spray for several seasons with arsenicals, then for several with derris or one of its relatives, thus catching the arsenic-immune strains that may have evolved with something to which they are not immune. Most of the fish-poison plants thus far experimented with are of tropical origin. One of the most promising recent additions is the South American "cube," pronounced "koo-beh." Both derris and cube, together with the majority of other fish-poisoning plants, are members of the legume family, relatives of clover and peas. It is proposed to grow them as fertilizer crops in rubber groves and other tropical plantations, thus obtaining two paying crops off the same land with the same labor and enriching the soil at the same time. But many other fish-poisoning plants belong to other plant families. One formerly used in southern Europe is the common mullein, which is now thoroughly naturalized in America as well. Fish-poisoning used to be carried on extensively in Greece and Spain, and in parts of Spanish America the method of catching fish by poisoning them is still called "barbasco," from "verbascum," the old Latin name of mullein. If mullein turns out to be an efficient insecticide, its cultivation should present no particular problem, for it is the rankest kind of a weed.

YEAST FOR COWS

YEAST which has been exposed to ultra-violet rays is better than cod-liver oil for increasing the rickets-preventing properties of cows' milk, according to Dr. Harry Steenbock, Flora Hanning and E. B. Hart, of the Wisconsin Agricultural Experiment Station at Madison.

These investigators have been trying for some time to find a way of increasing the antirachitic property of cows' milk. The majority of infants fed on it get rickets. Earlier observations showed that summer-time milk had slightly more vitamin D, the rickets preventive, than milk produced in winter. Experiments showed, however, that it was not because the cows were getting more ultra-violet light in summer that their milk had more vitamin D in it.

Next experiments with the cows' diet were made. Cod-liver oil which prevents rickets in man was not satisfactory when fed to the cows. Fed in large amounts, it lowered the secretion of butter fat. Fed in small amounts it produced little, if any, effect of an antirachitic nature. Excellent results were, however, obtained from irradiated yeast. Two hundred grams fed daily to cows producing from thirty to forty pounds of milk increased the vitamin D content of the milk many fold. Even fifty grams furnished enough vitamin D to make the milk highly antirachitic.

Apparently by the use of irradiated yeast one of the most outstanding deficiencies of cows' milk can be corrected in a practical way. With the present cost of yeast production, it should be possible to give milk all

the vitamin D required for normal nutrition at a cost of a fraction of a cent per quart.

The use of yeast has a further advantage in that the amount of vitamin in the milk can be controlled by the feeding of a standardized yeast preparation in amounts adjusted to the milk production. The applicability of the use of irradiated yeast for the enrichment of human milk still remains to be worked out.

AMERICAN DIALECTS

THE dry New England manner of speech, the Southern drawl, Pennsylvania Dutch rising inflections, the Western twang—we pick them out by ear as we hear Americans talk. But now, two professors at Columbia University are collecting American dialects and making a careful scientific analysis of subtle differences. The New Englander of the sea-coast, for example, has a different way of using tongue and lips in his speech from the New Englander of the hills.

More than 200 phonograph records, including fifty speeches by famous people, have been collected by Professor Harry M. Ayres and Professor W. Cabell Greet. Their library contains what would appear to be a strange collection of literature, 150 copies of the same story, "Grip the Rat," but every copy of the story is spoken by a different American voice. They have been aided in collecting varieties of American speech by the fact that the 14,000 summer-school students at the university have a convenient custom of gathering beneath trees named for their states. Here, on the campus, can be picked out and sorted plenty of dialects, pure and mixed.

In a progress report to the journal, *American Speech*, the two professors point out that education does not completely eradicate local speech peculiarities. Students reproduce local traits to a surprising degree, they have found. The terror of the microphone proves an aid in scaring artificial mannerisms out of most students who have added their voices to the collection.

The report goes into detail regarding differences in specific vowels and consonants in various parts of the United States and Canada. The typical New Englander of the coast speaks with a sharp attack and brisk utterance. The vowel *a*, which is one of the letters that has a vivid and changeable personality on the American tongue, is most typically New England in "asked," "aunt," and "can't" where the tone is placed far in front. In "barn," the *a* is located slightly farther back, and the professors explain that in no case is this sound as far back as in the ordinary American pronunciation of father.

The mountain New Englander has "a slow elegiac cast in his speech tune, a certain doubt as to the advisability of proceeding, coupled with a resigned acceptance of the necessity of doing so," the report graphically explains. The *a* sound in this region is shorter than in the speech of the sea-coast.

This example of contrast indicates the analytic method of the study, which goes into much detail and uses many technical terms such as fronting, cupping and vowel gliding, to describe the sounds Americans make when they talk.

Records of the various speech types of a single community—Williamsburg, Virginia—were this summer gathered under the direction of Professor Greet and should yield interesting results, Professor Ayres stated.

TOOTH DECAY

TOOTH-DECAY can not be averted by the regular use of antiseptic mouth-washes and tooth-pastes, if you continue to eat too much sugar. Dr. Russell W. Bunting, professor of dental histology and pathology at the University of Michigan, has based this conclusion on crucial experiments which he has carried out on a large number of school children.

Dr. Bunting and his associates selected three groups of children. To one group they prescribed an antiseptic mouth-wash twice daily without putting them on a special diet, and to the two other groups they prescribed in addition to the mouth-wash a well-balanced diet, in which sugar was eliminated except as it was used in cooking to make foods palatable. These children had no sugar on cereals, in beverages, very little sweetened preserves and pastry, and little or no candy.

The results of these experiments, which lasted for nine months, were striking. Two thirds of the children who used the mouth-wash only developed extensive dental caries, whereas in the children kept on a relatively sugar-free diet not a single vestige of active caries appeared during the year, and cavities already present did not increase in size.

Dr. Bunting's experiments constitute the first successful attempt to eliminate tooth-decay in a large group of children. They show that little or nothing can be accomplished by pastes or mouth-washes without proper diet.

The importance of diet in the hygiene of teeth is further demonstrated by recent experiments of Mrs. May Mellanby, of London. She has shown that puppies developed extremely poor teeth if vitamin D, the rickets-preventing vitamin, was excluded from the diet. But since typical caries does not occur in dogs, the relation between vitamin D and this disease can only be determined in man. Experiments dealing with vitamins as possible causes of human tooth-decay are now being carried out by Mrs. Mellanby in England.

ARID-LAND FARMING

PRESENT-DAY irrigation and dry farming constitute, in a way, a return to the ways of our earliest civilized forebears. Civilization originated in the semi-arid lands of the world, and only after the lapse of centuries did farming leave such places as the valleys of the Nile and the Euphrates and reach its greatest development in the moister, cooler lands of the temperate regions. Now we are again paying attention to the lands of little water, using methods that are basically the same as those of the earliest farmers but with the advantages and improvements that can be derived from modern science.

This is one of the points brought out in a review of principles and methods of soil utilization, presented at

the Second International Soil Science Congress, meeting in Leningrad, by Sir John Russell, head of the great agricultural experiment station at Rothamsted, England, the oldest institution of its kind in the world.

The two principal means of gaining a profit from warm lands of little rainfall, Sir John pointed out, differ radically in their methods and in their results. The first, which dispenses with artificial watering, devotes itself mainly to the support of grass crops, either as grazing lands producing principally wool, or as dry-farming areas producing cereals. The second, which uses irrigation, is too expensive for staple food production except in such lands as Egypt where the object is more to keep the population alive than to realize profits. Elsewhere irrigated lands are given over primarily to specialized, high-price crops, such as fruits.

The soil problems of dry-farmed land are quite different from those of the more humid regions. In ordinary farm lands organic matter in the soil is counted indispensable; it is not found so in dry-farmed lands. More than 25 per cent. of clay in a moist region condemns land as untillable and consigns it to the category of permanent pastures. In arid regions the clay content may run as high as 50 per cent. without destroying the tillability of the soil. Nitrogenous fertilizers are not so necessary on dry as they are on moist lands, but sulfur and sulfates are often effective.

"Considerable success has already been achieved on these soils," said Sir John. "Much of the world's wheat and wool is now grown on them, and there is distinct promise for the future."

NEW DISEASE

DISCOVERY of a new occupational disease among railway train dispatchers in America is reported by the Industrial Health Conservancy Laboratories of Cincinnati. Of a group of 165 dispatchers from seventeen different railroads examined, two thirds were afflicted with an involuntary to-and-fro shifting of the eyes which is the characteristic symptom of nystagmus, as the new disease is called.

Until the present time, America has been regarded as free of this occupational menace, which has taken a great toll of mine workers in England since its discovery there. Its exact cause is not definitely known, some authorities attributing the disease to deficient illumination and others to the eye strain resulting from constant motion of the eyes following objects in motion, as the eye of a miner follows the point of his pick or the sewing machine operator watches her needle. Explaining the appearance of the optical ailment among train dispatchers, the fatigue theory has been forwarded as more logical and continued use of a train sheet blamed for the eye strain.

Reports from the U. S. Public Health Service of Washington state that previous to this time practically no evidence of nystagmus has been discovered in this country. The Illinois commission examined 500 pick men in the mines of that state but did not find a single victim. From this it was assumed that superior hygienic working conditions in the United States rendered the American laborer immune from the disease that was cutting into the ranks of English workmen, often incapacitating them for work in the prime of life.

Naturally strong eyes appear to be no guarantee against the inroads of nystagmus. Dr. J. W. Tudor Thomas, of the Cardiff Royal Infirmary, found from a study of five hundred cases of nystagmus among miners, that as many workers originally blest with normal vision had been afflicted with the disease as had workmen with defective eyesight. Neurotic tendencies, alcoholism and anemia are thought to be factors increasing the hazard of nystagmus. That workers in coal mines are the most frequent sufferers further suggests that the absence of colors may in some mysterious way react unfavorably on the eyes.

ITEMS

TEN pounds of flake ice will melt twelve and a half times as fast as a 10-pound block, Crosby Field told the American Institute of Chemical Engineers at their recent Detroit meeting. Thus it will cool a chemical reaction generating heat much faster than other forms of ice. "The new ice looks very much like broken peanut brittle except for color," Mr. Field said. "A 300-pound standard cake of ice has a surface area of 20.7 square feet, whereas 300 pounds of one-eighth-inch thick flake ice has 1,000 square feet of surface, an area nearly fifty times as great. But the effective ratio of surface area in use is far greater than that indicated by these figures because the surface of the flakes remains practically unchanged as they melt while the area of a block gets much smaller."

DRY cleaning fluid, to work properly, should be clear enough to read ordinary newsprint through 11½ inches of it, should have a sweet odor, should be light in color and free from moisture, fatty acids and alkali. These are some of a series of 11 tests for the use of dry cleaners to determine when their cleaning fluid is exhausted. At the meeting of the American Chemical Society in Cincinnati, Ralph A. Morgen and Frank Fair described these tests. In order to give satisfactory results, they stated, it is not necessary that the fluid be maintained at the same specifications as the original, but it should be maintained at a sufficiently high quality to give good cleaning.

THE clinometer, a simple device which enables one man to determine quickly the aviator's "ceiling" at night, has been designed recently by Dr. C. F. Marvin, chief of the U. S. Weather Bureau, and is being put in use at army and navy flying fields. It is used in connection with a searchlight focused vertically on the clouds. At a certain distance from the light, often 1,000 feet, the observer sights the clinometer on the white spot on the clouds and measures the angle of sight with a pendant which hangs on a scale attached to the instrument. Then with the ground distance and angle of sight known, the vertical height of the clouds can be readily calculated as the leg of a right triangle.

SCIENCE NEWS

Science Service, Washington, D. C.

CRYSTALLIZED RUBBER

CRYSTALS of rubber, an important step toward the discovery of the composition of this familiar material, have been produced in the chemical laboratories of the U. S. Bureau of Standards in Washington. In achieving this result it was necessary for Dr. W. H. Smith, chemist, to make the purest rubber yet produced. A long process of purification gave a block of rubber as transparent and colorless as window glass. This material, dissolved in ether, and cooled to 80 degrees below zero Centigrade formed minute crystals of rubber, plainly visible under a magnifying glass. Dr. Smith even succeeded in photographing at this low temperature the fine crystals of rubber, and he expects in the near future to publish a scientific report on his work.

Once a small quantity of the crystals is isolated, the chemical composition can be determined by burning them and otherwise analyzing them. This should give the true formula of rubber, which the best estimates indicate may have the molecular composition of some multiple of five carbon atoms and eight hydrogen atoms. When the structure and composition of rubber is definitely known there will be much greater hope of its synthesis from common sources of carbon and hydrogen, such as coal. The researches just made at the U. S. Bureau of Standards may therefore in the distant future lead to the freedom of the United States from the dominance of foreign-grown rubber, but for the immediate future chemical methods of production are not expected to compete with the natural product.

Rubber was distilled for the first time in history when Dr. Smith took some of the pure, colorless rubber and by placing it in a vacuum at 100 degrees Centigrade temperature succeeded in making it evaporate from one side of a flask and solidify on the other side.

The researches were carried out in the division of chemistry, of which Dr. E. W. Washburn is chief, and they were announced by Dr. G. K. Burgess, director of the Bureau of Standards.

INSECT POWDER

THE poisonous principle of old-fashioned insect powder has been traced to its lair by C. B. Gnadinger and C. S. Corl, research chemists of Minneapolis, Minnesota. The powerful poison of the material has been located largely in the achenes, or fuzzy seeds of the pyrethrum plant, from which it is prepared. Pyrethrum, a variety of chrysanthemum, has been used to abate insect nuisances for generations. The flowers and even leaflets and stems of the particular species are commonly ground into a fine powder, which is extremely toxic to insects but harmless to man. Some time ago the noted Swiss chemist Staudinger solved the mystery of the chemical formula of "pyrethrin," the potent oil which gives the value to the insect powder. The oil is actually a mixture of two similar but complicated substances containing only carbon, hydrogen and oxygen, innocent elements when in simple relations. Being an oil, it may be diluted in gasoline or like solvent and used in sprays where dusting powders are undesirable.

The two Minneapolis chemists have now discovered a method of chemical analysis whereby one may quickly tell which plants, and which parts of the plants, contain the poisonous principle. Armed with the new method they have upset several long-standing beliefs in the insect-powder business. Japanese pyrethrum has been found to be just twice as potent as the classic and more expensive Dalmatian powder. Also the mature flowers are more valuable than the unopened or half-opened buds, which the trade prizes and holds at higher prices. Stems and florets have relatively little value compared to the achenes.

The extreme toxicity of pyrethrin was shown in the Minnesota experiments by a test on cockroaches. A solution of one part of the oil in 80,000 of water effected a complete slaughter of a colony of the pests submitted to the test.

The perfecting of these chemical experiments opens the door to most promising research in plant breeding. Just as the sugar content of beets was raised in cultivation, so may it be possible to increase the pyrethrin content of chrysanthemums. At present only about one half to three quarters of one per cent. of the powder is actual poison. Modern selection methods as practiced by plant breeders would probably lead to great increase in efficiency in agricultural pest control. It is also considered possible that the essential principle itself may be made synthetically if the demand should be sufficient.

VITAMIN D

A NEW use for the rickets-preventing, bone-building vitamin D is being investigated in medical fields. Shortening of the time required for blood to clot, vitally important in operations, by the feeding of vitamin D (or ergosterol irradiated with ultra-violet light), is the result which W. C. Corson, G. F. Irwin and I. A. Phillips, of the Washington University School of Medicine, recently reported as a result of tests made on white rats.

The formation of a clotted mass of blood is nature's way of stopping the flow of blood through an open wound. Without some such means, most of us would have bled to death long ago. The average normal time required for the formation of this clot is 2 minutes, 10 seconds. It is this length of time which the medical profession wish to see shortened, for to some patients, two minutes of blood flowing freely might be most disastrous.

Normal blood contains in each thimblefull about 600,000 bodies known as thrombocytes. These thrombocytes are the points or foci where coagulation of the blood begins whenever the blood leaves the small blood vessels and comes in contact with something different.

By increasing the thrombocytes, it then would be possible for the blood more quickly to form this clot which will stop bleeding. The sooner the blood issuing from the open wound thickens and stops flowing, the less blood the patient loses. These three scientists made interesting findings along this very line.

Each animal receiving vitamin D (as ergosterol irradiated with ultra-violet light) showed a marked decrease in the coagulation time which occurred simultaneously with the marked increase in the thrombocyte count. The thrombocyte count was doubled in 48 hours. The highest counts recorded, which were as high as 3,000,000 from a normal count of 600,000, were obtained on the fifth through the seventh day after the initial dosage. The lowest coagulation time (15 seconds to 30 seconds) occurred also on the fifth through the seventh day.

The fact that the results of the feeding of vitamin D do not reach their maximum until the fifth day may be of great importance to the surgical profession. "Bleeders" are people whose blood does not coagulate or clot readily. To them this new phase of the use of vitamin D may be of untold value. Again, certain diseases have such an effect upon the blood. In jaundice, for example, the effect of the disease is in some way to cut down the power of the blood to clot when bleeding occurs. The report deals as follows with this: "We hope to demonstrate by further experiments that the coagulation time which is prolonged in obstructive jaundice can be shortened sufficiently to reduce the operative risk."

CATTLE TICK

THE success of a twenty-four-year war against the cattle tick, cause of the costly animal disease known as southern Texas or tick fever, was reported by W. W. MacKellar, of the U. S. Bureau of Animal Industry, to the Inter-American Conference on Agriculture, Forestry and Animal Industry, which met in Washington this month. According to Mr. MacKellar it is possible and practicable to eradicate the cattle tick permanently from any section. This fact has been established as a result of the practical work which the U. S. Bureau of Animal Industry has been conducting since 1906.

Long before that, in 1893, Theobald Smith, veteran microbe hunter of America, reported the cause of Texas or tick fever, and explained how to wipe out this disease which was playing havoc with cattle. Dr. Smith showed that the disease is carried from one animal to another by the tick and that the germ of the disease must spend part of its life cycle in the body of the tick. When the tick is eradicated, the disease will be wiped out also.

When this eradication project was started in 1906, 983 counties with a total area of 728,565 square miles in the states of Alabama, Arkansas, California, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas and Virginia were under federal quarantine because of tick infestation. At the close of 1929 the quarantined area had been reduced to 184 counties containing 151,198 square miles in Arkansas, Florida, Louisiana, Mississippi and Texas. This means that about four fifths of the originally quarantined area has been freed from ticks, released from quarantine and made safe for the greater development of the cattle industry.

The practical work has shown the best and cheapest method of treating the infested animals is the arsenical cattle dip. The animals are treated at fourteen-day intervals from March to November. At the same time quarantine measures are enforced until the ticks are completely eradicated.

INDIANS OF TEXAS

CAVES of eastern Texas, inhabited by an ancient people, may help science to explain how the mysterious Mound Builder culture found its way to the Mississippi Valley where it flourished in prehistoric times. Matthew W. Stirling, chief of the Bureau of American Ethnology, has just returned to Washington from exploring this western region, which is still practically untouched by archeologists. He reported finding caves bearing traces of human occupation and apparently well worth investigation by Smithsonian Institution expeditions.

The Indians who built fires in the cave shelters and left their broken tools and dinner bones there to be buried in dust and débris were probably similar to the Basket Makers of the early Southwest. Greatest interest in these caves hinges on the fact that they are along the route where the Mound Builder culture presumably advanced if it spread overland from Mexico to the Mississippi Valley. Here may be preserved some evidences of those ancient happenings.

One question to be answered is whether there was an actual migration of Aztecs or some other tribe from the south, or whether the Mexican Indians merely passed along by trade contacts their ideas of building high places, and art designs, and other knowledge and customs that they shared with the Mississippi Valley Mound Builders. Mr. Stirling selected sites in northeastern Nevada which seem promising for excavation. Both eastern Texas and northeast Nevada are marginal regions where important cultures, spreading out from their centers, may have overlapped.

A SPECIAL TYPE OF BALDNESS

A DRUG is now on the market which will help a special type of baldness known medically as alopecia areata, Dr. C. N. Myers, of the H. A. Metz Company, Brooklyn, N. Y., reported to the American Chemical Society meeting at Cincinnati. Dr. Myers also reported the results of his chemical studies made on people suffering from this condition in which the hair falls out in localized areas only. This type of baldness is not the common variety for which a cure has long been vainly sought. The tiny blood vessels of the skin were either entirely invisible or showed marked constriction, microscopic examination showed. The blood contained more sugar and less chloride or salt than normal. In a large pro-

portion of the cases, arsenic and lead were found in harmful amounts in the blood and in the kidney secretion. The drug which was found helpful in treating the ailment is a sulfur compound, known commercially as sulfactol, a brand of crystalline thiosulfate.

ELECTRON STREAM MOTOR POWER

A MOTOR that runs by a stream of minute electrons is the latest modification of the vacuum tube that makes home radio sets possible. In the forthcoming issue of *Electronics,* this tube, the invention of Allen B DuMont, chief engineer of the DeForest Radio Company, is described.

In the center of the DuMont tube is the filament, immediately surrounded by a cylindrical cathode, from which the electrons emanate. Around the cathode hangs a cylindrical grid, suspended from a bearing at the top so that it is free to turn. In the grid are a series of vertical slots, with small blades projecting from one side of each of the slots. All the blades point in the same direction.

As the filament is turned on, the electrons are shot out from the cathode at a high speed, and after passing through the slots in the grid they hit the blades and bounce off to the outside. The impact of each electron is very minute, but with the great numbers that hit all the blades there is sufficient force to start the grid rotating. No practical use has yet been found for the tube, as the power developed is very small. It has been suggested that it might be used for a clock, however, or as a source of alternating current.

Some years ago the famous English physicist, Sir William Crookes, who was one of the original experimenters with cathode rays, or streams of electrons, used them to produce a rotatory movement. In one of his cathode ray tubes, the stream of rays was aimed at a small windmill-like device in the tube, and the windmill spun round very rapidly when the tube was operating. But this tube required high voltages to operate it, while the DuMont tube will work on voltages of the same order as used in radio equipment.

CHILD DELINQUENTS

DR. BRYANT E. MOULTON, of the Judge Baker Foundation of Boston, states that psychiatrists who probe into the minds and the conduct of delinquent boys and girls should not fail to look into the families in which those boys and girls live. Very frequently more psychiatric work should be done with the family than with the child to get any lasting results. Many transient cures upon which considerable time is spent would have been permanent if the family background had been altered.

One ten-year-old boy who was sent to Dr. Moulton had a persistent tendency to run away. The root of this desire was found only when home conditions were investigated, and it was shown that the child was overwhelmed by the sense of family insecurity. His father was employed very irregularly, and there was much anxiety and agitation about making ends meet, with frequent quarrels between the father and mother over the payment of bills. Such conditions alarm and depress a child by the feeling that the home is insecure, and the child's reaction may take various forms which neither he nor the parents understand.

Ignorance on the part of parents, also prudishness, fanaticism, are so common that they are frequently overlooked as contributing causes of a child's strange or unsocial behavior. Such basic causes in a child's environment are too often overlooked by specialists who attempt to set the child right with his world, but who do not try to set the world right for the child.

ITEMS

THE heating effect of electrical rotating machinery is no longer entirely a loss. Temperature increases caused by resistance, eddy currents and magnetic effects in direct current and synchronous motors and generators are now being scientifically used to warm the buildings which house the equipment. In recent installations sheet metal hoods of a new design collect the air warmed by the revolving machinery and transfer it to ducts which carry it where it can be used most effectively for heating. In the summer it is exhausted in the open to keep the buildings cool. Made to take advantage of the ventilation characteristics of the machinery, the new hoods also greatly reduce windage losses. Cool air enters near the ends of the armature shaft and is discharged along its circumference. Although the machines under the hoods act as fans and pump their air, they operate more efficiently than they would in the open or enclosed the old way.

A GOITER preventive found in certain plants was described by Drs. Emil J. Baumann and David Marine, of New York City, at the meeting of the American Chemical Society at Cincinnati. The preventive is not iodine, the investigators reported. It may be a hexuronic acid, a hitherto unknown but very active acid related to starches and sugars. This acid was recently found in cabbage, orange juice and suprarenal glands by Dr. Albert Szent-Györgyi, of the Mayo Foundation. Drs. Baumann and Marine conducted their experiments on rabbits. The animals developed simple goiter when fed on a diet of cabbage or turnips or related plants. The development of the goiter could be prevented by giving the animals certain plants or certain plant juice concentrates which apparently contained a goiter preventive.

CHILLING on ice hastens the germination of the large edible nut-pines regardless of their native habitats, according to G. R. Johnstone and Tema Shults Clare, of the department of botany of the University of Southern California. Torrey pine seeds from the Torrey Pine Preserve near La Jolla require 25 days of chilling, while the seeds of Coulter and Digger pines require 60 and 50 days, respectively, for the highest percentages of germination. Experiments dealing with the chilling of one-leaf piñon pine, another of the edible pine seeds, indicate that 30 days on ice are followed by the best germination.

SCIENCE NEWS

Science Service, Washington, D. C.

INFANTILE PARALYSIS

CURE of infantile paralysis, or poliomyelitis as it is called technically, depends on early recognition of the disease, for the methods of treating it are most successful when applied in the first stages. Mothers generally attend to the illnesses of their children, and while they can not hope to make a diagnosis of this disease unaided, they can learn to suspect its presence so as to call for medical aid in time.

Unfortunately, neither the cause nor the method of transmission of the disease is known. Control methods depend on isolating the patient. Prevention also depends on keeping children and young people away from persons suspected or known to be suffering from the disease. In times of epidemics, it is wise to keep children away from strangers, also.

"The paralysis itself is due to the destruction of the nerve cells in the spinal cord which govern the movement of muscles," Dr. W. L. Aycock, of the Harvard Medical School, has explained. "When these nerve cells are destroyed, the muscle with which they are connected loses entirely its power to function. It is like a telephone which may be in perfect order itself but which can not function without a wire leading to it from the telephone exchange."

Consequently treatment for the disease must be begun before the nerve cells have been destroyed, if paralysis is to be avoided. Once it has occurred, it is too late to cure it, although patient treatment and care and exercise can do much for the affected muscles. Skilful treatment, if paralysis has occurred, is of great importance, because in growing children the pull of unparalyzed muscles against those which are paralyzed tends to produce serious deformity. The paralysis is practically always preceded by certain definite symptoms. It is during this preparalytic stage, before the nerves have been destroyed, that there is a chance of cure. Serum from the blood of persons who have passed through an attack is the one remedy at present available for treating the disease in the preparalytic stage. Doctors speak of this as convalescent serum.

The onset of poliomyelitis is usually abrupt, with fever, headache and stomach and intestinal upset. The child is drowsy and wants to be let alone. Usually he seems sicker and more prostrated than would be expected with the degree of fever, which is generally not over 102 degrees Fahrenheit. An anxious expression of the face, tremors and twitchings of the muscles and a sort of uncertainty in the movement of the arms and legs are characteristic of the early stages of the disease. The most suggestive sign is stiffness of the spinal column and neck. The child will hold his head and neck rigidly and often he can not sit up comfortably without propping himself on his arms.

Every stiff neck is by no means an indication of infantile paralysis, of course. The stiff neck of this disease is a rather special one. But if the mother finds such a symptom, she should at least suspect the disease and have the matter further investigated without delay.

The paralysis may set in anywhere from one to three days after the onset of the disease. The extent of it varies. When death occurs, it is from paralysis of the muscles used in breathing and not from the severity of the fever.

A NEW ANTI-FREEZE MIXTURE

WILL people get chronic or acute poisoning if wood alcohol is used generally as an anti-freeze mixture for automobile radiators? This is one of the questions which government scientists are trying to solve as a result of the proposal to introduce synthetic methanol as an anti-freeze mixture next winter.

Methanol, as wood alcohol is called by chemists, used to be made by distillation of wood. This made its cost high. By the new method, it is made by combining the deadly carbon monoxide with hydrogen, the raw materials being coal and water. This makes synthetic methanol very much cheaper than the product obtained by distillation. Whether it can be used safely in automobile radiators has yet to be determined.

When swallowed, wood alcohol is a poison which may cause blindness and death. Careless bootleggers have mistaken wood alcohol for the less deadly ethyl alcohol, with disastrous results to their clients. This use of the new anti-freeze is to be guarded against by giving it a distinctive color, it is planned.

However, the question remains whether the fumes could not get into the body either by absorption through the skin or by inhalation through nose and mouth, and thus cause disease and possibly death. How much of the substance can get into the body in these ways, and how much will cause poisoning, either chronic or acute, must be determined.

It may be that the new anti-freeze mixture can be used safely if certain regulations are followed and certain precautions taken, as in the case of the anti-knock gasolines. These contain a small amount of tetra-ethyl lead. When they were first introduced there was a question as to whether people generally would be in danger of lead poisoning from the exhaust, and whether men selling it and working in garages where it was sold were risking their health. Cases of lead poisoning in the plants where the anti-knock mixture was made heightened the public anxiety. But scientists found that the only real danger was in the manufacturing plants and that even there, as in other lead industries, certain health precautions, if followed, would safeguard the workers.

A possibility exists of certain people being more susceptible to methanol poisoning than others, and of certain people having the kind of skins that would absorb more of it than others. This also will be investigated, according to Dr. R. R. Sayers, of the U. S. Public Health

Service, who is in charge of the investigation. Chemists of the U. S. Bureau of Mines at Pittsburgh will make chemical and laboratory tests, working with animals. The U. S. Public Health Service is making field tests on men who are now exposed to synthetic methanol.

Ethyl alcohol, closely related to methanol, which is methyl alcohol, is largely used at present as an anti-freeze mixture in automobile radiators. Its chief disadvantage is that it evaporates quickly and must be constantly replaced. It is not poisonous like methanol, because man can develop a tolerance to it. Another popular anti-freeze is ethylene glycol, which is made synthetically from petroleum and has the advantages of both ethyl alcohol and of glycerine, also widely used. Ethylene glycol and glycerine are more expensive than ethyl alcohol, which in turn costs more than synthetic methanol. The latter is being made by three large companies who make over six million gallons a year.

THE PROTECTION OF TROPICAL FORESTS

PLANS for protecting the great tropical forests of the Americas from careless exploitation, such as has laid waste the forest sections of other parts of the world, were discussed at the meeting of the first Inter-American Conference on Agriculture, Forestry and Animal Industry.

Forest land in the twenty Latin-American republics is estimated to cover an area of 3,000,000 square miles, which is larger than the total area of continental United States exclusive of Alaska, according to William R. Barbour, forester of the Tropical Plant Research Foundation. So little research has been done in these forests that only vague guesses can be made as to the volume of standing timber in them. A safe estimate places it at at least six thousand billion board feet.

"Too little is known about the forests of tropical and subtropical countries," said W. T. Cox, consulting forest engineer of the Tropical Plant Research Foundation. He urged extensive forest exploration aided by airplane, so as to get not only botanical information of the numerous trees but also commercial classifications. The training of young men in forestry and the development of these vast forests along scientific principles were advised.

"In the two Americas constructive forestry is still in its beginning," said Dr. E. P. Meinecke, plant pathologist of the Bureau of Plant Industry of the U. S. Department of Agriculture. The nations of the two Americas have a common interest in building up their forests for the benefits of coming generations and to this goal the protection of the forests against disease is one of the most promising and essential conditions. The greatest menace from killing forest epidemics has come through the accidental introduction of forest diseases. The science of forest pathology, which would take care of these disease conditions of trees, must be organized on international lines in order to find its true place in modern forestry.

The danger of looking for temporary reward rather than for ultimate benefit in the cutting down of forests and development of the land for other purposes was described by Professor D. M. Matthews, of the University of Michigan School of Forestry and Conservation. The reckless waste of trees which results from using the land for other purposes is not the only evil. The removal of the forest cover may have a bad effect on the productive capacity of other permanent agricultural areas in the region, he pointed out. This is too frequently overlooked in the clearing of land.

Other speakers emphasized the need of studying the little-known woods of these forests with a view to their possible uses in future decades when both Latin-American countries and the United States will have to turn to these forests for most of their lumber.

MAGGOTS IN WOUNDS

SOMETHING more than a scavenger reaction is behind the successful healing of wounds by the new maggot treatment, its discoverer, Dr. William S. Baer, of the Johns Hopkins University, told the group of scientists gathered in Baltimore, Md., for postgraduate study of bone diseases and cancer of the bone.

A specific reaction between the serum of the body and the maggot itself probably causes the healing of wounds to which maggots are applied. Just what this reaction is has not yet been discovered, he said.

Dr. Baer told how his experiences as an army surgeon during the World War started him on the investigations leading to the new treatment. Two men were brought in who had been lying in the field for seven days without food. They suffered from abdominal wounds and from compound fracture of the thigh bone. The wounds were covered with maggots, the tiny larvae of flies. The men were hungry, but otherwise their condition was good.

In the hands of the best surgeons, the mortality for compound fracture of the thigh bone was 80 per cent., Dr. Baer knew. In other words, four fifths of the persons who suffered from that condition died. In the hands of the maggots, the mortality for those two men was nothing. Instead of the bad infections commonly found in such injuries, Dr. Baer found only a few harmless organisms.

For ten years he puzzled over these cases, particularly when treating children suffering from osteomyelitis. This disease of the bone is the result of an infection, is more common in children than in adults and is extremely difficult to cure. If it reaches the chronic stage, recovery is often delayed for years. Finally he tried the effect of maggots on some of these cases. In six weeks the children were entirely well. Dr. Baer has used this method on 300 patients during the last two years. All the children have recovered entirely. With adults the treatment has been successful in four fifths of the cases. Lack of success in the other one fifth Dr. Baer thought might be because adults do not stand the treatment well and it can not be given continuously.

At first it was thought that the success of the maggots in cleaning and healing wounds was due to scavenger action. The tiny larvae ate up the dead tissue about the wound and the bacteria died from lack of sustenance.

Now it is thought that something more than this is responsible for the success of the treatment.

HEPTANE, RARE RESIN PRODUCT

FROM healing wounds to measuring the knock of different gasolines seems a far cry, yet heptane, a resin product secured only from two species of pine, seems destined to serve these two widely differing purposes, C. L. Hill, of the U. S. Forest Service, has reported.

The two trees from which heptane can be derived are just as far apart on the commercial scale. One, the Jeffrey pine, is a valuable timber species, sometimes known to the mountain people as the apple pine because of the odor of apple or pineapple that is usually emitted by its bark. This tree is found in the higher mountains throughout the greater part of California. The second tree furnishing heptane is the Digger pine, which previously has been considered a species of little value, used primarily for fuel. It occurs throughout the foothills and lower levels of both the Sierra Nevada and Coast Range of California.

While the development of heptane from an industrial standpoint is new, the curative value of the resin from these two trees, when applied to cuts and wounds, was long ago discovered, and during the Civil War agents of the Union Armies went to far-off California to secure it. Of recent years, however, its medicinal use has dwindled, and it has been more or less classed with the herbs of our grandmothers' time.

According to Mr. Hill, it was about twenty years after the Civil War that chemists at the University of California discovered that the liquid obtained by distilling the resin of the Jeffrey and Digger pines was a hydrocarbon called normal heptane. This heptane, also commonly found in petroleum, is quite different from the terpenes which form turpentine and which were supposed to be produced by distilling the resin of any pine tree, so the announcement of its discovery caused quite a furore in the chemical world. It was many years before the findings of the California chemists were generally accepted among the chemical profession.

Even then, however, the production of heptane from pine trees had no definite commercial value. It has only recently been discovered that heptane, in connection with octane, the hydrocarbon next to it in the same chemical series, can be used for the laboratory measurement of the knock of different gasolines, and so determine the dosage of tetra-ethyl-lead that is necessary to neutralize that knock. Experiments are now in progress to perfect this method of measuring gasoline knock.

NEW USES FOUND FOR HELIUM

HELIUM, first discovered in the sun and later obtained at great expense in minute laboratory quantities, is now familiar to every one as the lifting gas for American airships. Soon, however, it may be even more common, for still other uses are rapidly being found for it. At the meeting of the American Chemical Society in Cincinnati, R. R. Bottoms and W. E. Snyder, of the Helium Company, Louisville, Ky., stated that "helium gas is now available in commercial quantities in the United States and there is sufficient supply to meet not only the needs of aeronautics, but for other uses as well."

The points that make helium valuable, they stated, are that it is inert chemically, not combining with any other element; it is very light; it is insoluble, conducts heat well and can be cooled to an extremely low temperature without liquefying. These properties, they say, make it valuable for use in metallurgy, for the preservation of food, for heating and cooling and as a circulating medium, instead of air, in drying systems. They also suggest that it can be used as an artificial atmosphere for deep-sea divers and caisson workers and for the treatment of diseases of the lung and blood. In such uses it would be employed as a substitute for ordinary air, the helium being mixed with oxygen and thus taking the place of the nitrogen in the atmosphere.

ITEMS

WITH an average of 798 pounds of fertilizer used on every acre of crop land during 1929, Florida leads the United States in the use of fertilizer, R. O. E. Davis, research chemist of the U. S. Bureau of Chemistry and Soils, told members of the American Chemical Society, at their recent meeting in Cincinnati. Next to Florida is New Jersey with 417 pounds per acre. On the whole, the states of the Atlantic seaboard use it much more extensively than those inland, though a great increase in its use has come since 1913 in the Pacific Coast states, and there is also a tendency to increased use in the West North Central states. Cotton uses on an average 108 pounds per acre, though 31 per cent. of all the fertilizer used is on this crop. On citrus fruits the rate is 1,163 pounds. Five principal crops consume about 82 per cent. of the fertilizer, though less than 25 per cent. of the acreage devoted to them is fertilized.

MORE solid carbon dioxide, commonly known as "dry ice," is now used than the liquid form of the gas, in which it was formerly marketed. D. H. Killefer, chemist of the Dry Ice Equipment Corp., New York City, told members of the American Chemical Society meeting at Cincinnati that nearly 30,000 tons of this former laboratory curiosity will be used during 1930. This is greater than the total amount of liquid carbon dioxide used in 1927, the latest year for which figures are available. It is used for refrigeration, because of its advantages over ice in being colder and in not melting, but changing directly from the solid form into the gas.

DEVELOPMENT of a large number of standard color samples, showing even gradation of all the three color variables and carefully calibrated by physical measurements, was urged at the meeting of the American Chemical Society at Cincinnati by I. H. Godlove, research chemist of the Munsell Color Company, Baltimore. He stated that something of this kind is needed to correlate the various color languages now in use. Such standards, he declared, would give freedom from personal vagaries, combined with a direct knowledge of "how a color looks."

SCIENCE NEWS

Science Service, Washington, D. C.

METEOR CRATER

THREE hundred thousand tons of meteors, in a close swarm, exploding as they hit the earth and producing effects as violent as 400 million tons of T.N.T. could have produced the famous meteor crater, nearly a mile in diameter, near Winslow, Arizona.

At the recent meeting of the American Astronomical Society in Chicago, Dr. Forest Ray Moulton, formerly professor at the University of Chicago and now a public utilities official, told of his conclusions, which leave little hope that there may be any of the original meteors left.

It has been thought that a much larger meteoric mass, perhaps ten million tons or more, would have been required to produce the effect, and that this great mass, possibly containing many rare elements, was near the crater, just below the surface, where it could be mined. Large sums of money have been spent in efforts to locate the mass, but so far they have not been successful.

Dr. Moulton, who is one of the country's leading astronomers, presented the following argument. A small meteor, perhaps weighing a pound or so, would enter the earth's atmosphere at its initial speed of around ten miles a second. At first it would be retarded very little, but as the atmospheric resistance increased to the point where it was greater than the gravitational attraction, then the meteor would slow up. Most of the energy is radiated away as light and heat, and the meteor burns up. But a meteor of larger mass, say a thousand tons, encounters very little resistance as it passes through the atmosphere, and when it hits the earth, it encounters a very high resistance. For a thousand-ton meteor hitting rock, Dr. Moulton calculates that the resistance is 50,000 tons per square inch and that it does work at the rate of 2,400,000 horsepower for each square inch. Even nickel iron is scarcely more resistant to these enormous forces than tissue paper, and so the meteor would be completely broken up and destroyed with explosive violence.

He also called into question the theory that many meteors come into our solar system from outer space. This has been suggested because some of the meteors have been thought to move at speeds which would carry them in the curve called a hyperbola. Meteors originating in the solar system would move in a parabola and it has been thought that many might come from the region of other stars where they might have originated in the same way that the home-made product was made. Dr. Moulton, however, expressed doubt that meteors, except in very rare cases, are moving along hyperbolas, and that therefore most of the shooting stars we see in the night sky, and the occasional meteorites that land on the earth, are members of the solar system, like the sun and earth.

POSSIBLE EFFECTS OF RADIATION FROM THE SUN

A HITHERTO unsuspected kind of radiation from the sun to the earth that is far more penetrating than X-rays and that approaches the cosmic rays studied by Dr. R. A. Millikan in penetrative power, is the cause of volcanic activity and earthquakes on the earth, and even of weather.

At the meeting of the American Astronomical Society, held recently in Chicago, Dr. Benjamin Boss, director of the Dudley Observatory, Albany, New York, presented this startling and sensational hypothesis to his co-workers. However, he declared that it does not do violence to generally accepted theories of to-day, but fits in with them. It provides a mechanism by which effects already known to be related may interact.

Dr. Boss believes that this radiation travels along the lines of the magnetic field of the earth. On this account it comes in near the magnetic poles of the earth, thus reaching all parts of the earth at all times. In this way he avoids any objection to his theory on the ground that the radiation should be greater as the earth faces the sun, and should be evident by its electrical effects, changing regularly every day. He believes that it is this constant flow of radiation that maintains the electrical field of the earth. The rays strike the earth and produce within the well-known "earth currents," he thinks, causing excitation of the atoms there. But as the intensity of the radiation varies, the excitement of the atoms changes, and they in turn expand or contract, thus causing great terrestrial effects such as earthquakes and volcanic eruptions.

Even the building of continents and mountain ranges, he suggested, have been caused in a similar way, as the radiation from the sun may have varied far more widely in the past, and may do so again. This was caused, according to the theory, as the sun passed through regions in space in which there was a difference of electrical potential, associated with inter-stellar matter or clouds of cosmic dust.

Similar radiation, Dr. Boss says, is emitted from all the stars, and it travels along the lines of magnetic force of the entire galaxy or milky way system. The nebulae in our system, he believes, are made of similar dark matter which is illuminated by stars passing through them, excited in a similar way. He said that the stars in these bright nebulae are in an intense electrical field, and that, as their atoms are excited, the star tends to become one of the class known as type O or B, which are blue in color and very massive.

The magnetic field of the milky way system, or galaxy, it is suggested, is caused as the charged atoms revolve around, for our galaxy is known to be rotating around a point in the constellation of Sagittarius. The fact that the dark regions of the milky way are centered in this constellation is seen by Dr. Boss as agreeing with his theory.

He also makes the suggestion that there may be a shift in the wave-length of light as it passes through a magnetic field, and that this may cause the lines in the spectra of distant spiral nebulae or "island universes"

to be displayed to the red, an effect that has been well observed in recent years.

This agrees with Einstein's theory of a curved universe, so Dr. Boss says that his ideas make the Einsteinian universe an electrical one. Similarly another proof of the Einstein theory, the shift of spectral lines in sunlight to the red, might thus be due to the effect of the sun's magnetic field.

SOIL EROSION

A REMEDY for the sinister scourge of soil erosion, which in this country has already destroyed enough land to support a nation, was described by H. H. Bennett, of the Bureau of Chemistry and Soils, of the U. S. Department of Agriculture, at the First Inter-American Conference on Agriculture, Forestry and Animal Industry meeting in Washington. Representatives of all of the twenty-one American republics are attending the conference.

"Not less than 126,000,000 pounds of plant food are being washed out of the fields of America every year," Mr. Bennett said. "Something like 17,500,000 acres of land that were formerly cultivated in this country have been destroyed by gullying or so severely washed that farmers can not afford to attempt their cultivation or reclamation. This is enough land to support a nation. It exceeds the total area of arable land in Japan.

An even vaster area of land has been injured by sheet erosion. This is a slower process of erosion, as distinguished from gullying, which removes a film of soil from entire fields whenever it rains enough for water to run downhill. Erosion operates chiefly on topsoil, the most productive part of the land. This is the humus layer, that vital part of the soil from which plants get their principal nourishment. When it is washed off, clay subsoil is generally exposed.

Mr. Bennett described some of the areas in various parts of the country where as much as forty inches of soil have been lost through erosion since the land has been under cultivation. In some places the land has been washed away to the underlying rocks.

Removal of trees from the slopes, destruction of prairie grasses by tillage, and disturbance of ground stability by plowing, overgrazing, excessive burning, freezing and thawing have resulted in this intensified soil impoverishment.

Cropping schemes, construction of terraces, soil-saving dams and vegetative obstructions are some of the means of reducing the evils of soil erosion. These have been tried in different sections of the country, particularly the South and West, and good results are already being reported.

We are not yet on the verge of a land shortage, but we are getting closer every year to a shortage of good land. Much of the losses already revealed by an expert survey can be reduced but the problem must be vigorously attacked at once. A tremendous amount of awakening among farmers, landowners, bankers, merchants and others to the seriousness of the problem is necessary, as well as a vast amount of research and demonstration work.

In regions where some of the land-saving measures are already being tried, it has been found that both the quantity and quality of the crop has improved. In the cotton crop, for instance, it was found that uneroded land, that is land which had not lost its topsoil, produced more lint cotton per acre, more seed, and the seed itself yielded more oil. Since cottonseed may be bought on the basis of oil content in the near future, this last is considered an important discovery.

DUST EXPLOSIONS

THE fifth and most severe of five dust explosions that have occurred in a month is now being investigated by the U. S. Department of Agriculture. David J. Price, engineer in charge of grain dust explosion work in the Bureau of Chemistry, has been sent to Decatur, Illinois, to study at first hand the disastrous explosion which occurred there on September 20, in a starch plant.

Just before departing, Mr. Price told *Science Service* that the plant in which the explosion occurred was a very modern one, and was considered to be one of the most progressive in the practice of methods for the prevention of explosions. Yet an explosion occurred, with five deaths resulting and two more injuries that are expected to be fatal. Because the explosion occurred despite all precautions, Mr. Price thinks that study of effects may reveal some hitherto unknown facts.

The first of the recent series of dust explosions occurred on August 20, in Baltimore, when a grain elevator was demolished with five deaths. This, also, was a very modern plant, in which all recommended precautions were taken. The next two were cattle-feed plants in Kansas City and Minnesota with three and two deaths each. Then occurred one in a tobacco plant in Richmond, which, fortunately, resulted in no loss of life. Mr. Price stated that this was one of the first explosions of tobacco dust, which is not ordinarily as hazardous as dust of other kinds, such as grain.

Dust becomes explosive when floating in the air, so that each particle has a plentiful supply of oxygen to enable it to burn rapidly. The same dust, if in a pile, might not burn, and might even extinguish a match plunged into it.

THE DIAGNOSIS OF CANCER

HIGH accuracy in diagnosing cancer from X-ray pictures was demonstrated by the group of 292 radiologists gathered at Baltimore for postgraduate study of the disease. Out of 200 voting on one case, 197 were correct in their diagnosis; in another, only one in 157 made a wrong diagnosis.

The scientists came at the invitation of Dr. Joseph Colt Bloodgood, of the Johns Hopkins University, who is sponsoring a series of postgraduate demonstrations to be given four times a year in connection with the Surgical Pathological Laboratory of the Johns Hopkins University. This session was devoted to bone cancer and other diseases of the bone.

"You should be well satisfied with yourselves," Dr. Bloodgood told the doctors after they had given their diagnoses on a number of cases. X-ray pictures were

shown of the diseased bone and lantern slides of microscopic sections of the tissues. The history of the case was briefly told them. Then they handed in their diagnoses and recommendations for treatment. Finally, they were told the diagnosis made of each case at the Johns Hopkins Laboratory, the treatment instituted, and the final result.

These demonstrations have inaugurated a new method of teaching, the mass intensive method, according to Dr. John M. T. Finney, clinical professor of surgery at the Johns Hopkins University.

"You will see here specimens such as you wouldn't see in a lifetime of practice," Dr. Finney said.

The last ten years show an increase of nearly 30 per cent. in the number of patients who are living five years or more after treatment for cancer of the bone, Dr. Bloodgood said at the beginning of the session. The cures have been accomplished by amputation, by cutting out part of the bone involved, and by irradiation with radium or X-ray.

The reason for the tremendous improvement in the cures is that people are learning to insist on immediate X-ray examination when there is any pain or swelling in the region of a bone or joint, regardless of whether there has been an injury or not.

Since the public has learned to come earlier for examination, the doctors must learn to distinguish cancer from other diseases in earlier stages than before. Correct diagnosis in this type of case often means the saving of a limb. The postgraduate demonstrations are planned to help the doctor to keep up with his patients and enable him to diagnose their diseases correctly no matter how early they come for examination. In this lies a hope of controlling cancer.

ITEMS

A TREACHEROUS little stream that flowed down a cliff-side and threatened to destroy the prehistoric ruins of Chetro Ketl in Chaco Canyon, New Mexico, has been foiled by a dam which forces the stream to take another course. Rescuing of the valuable pueblo ruins was done by two Navajos, by the direction of the University of New Mexico and the School of American Research, which conducted new researches at the site this summer. The stream has been undermining the pueblo for years and has caused serious curvature in some of the walls. The latest excavations at Chetro Ketl show that the pueblo was a story taller than has been supposed, and that it stood five stories tall in its prime. This discovery gives Chetro Ketl the distinction of being the largest pueblo in the canyon, even larger than the Pueblo Bonito which also was a five-story settlement.

THE prediction by Dr. Sven Hedin, Swedish explorer of Central Asia, that in 25 years the River Tarim in Chinese Turkestan would abandon its course and return to an ancient channel farther north has now been fulfilled, according to a communication received at Washington. The river is running now where it did 1,600 years ago. Dr. Hedin's attention was called to the wandering stream when he tried to follow a Chinese map 1,600 years old. It appeared that the Chinese geographers had made a mistake, for the river on the map was not on the landscape, but instead there was a "new" river to cross 550 miles away. After studying geological conditions, Dr. Hedin justified the Chinese scholars and their map by explaining that the southern branch of the Tarim apparently swings back and forth like a pendulum. He predicted then that the accumulating silt would soon drive the river to seek its old course.

BOILING mercury will take the place of electric motors and pumps in home refrigerators if a new method just announced comes into general use. The new process is the invention of Dr. Daniel F. Comstock, president of Comstock and West, and Lyman F. Whitney, of the firm's technical staff. Dr. Comstock was a former member of the faculty of Massachusetts Institute of Technology and was one of the inventors of the technicolor process of motion pictures in color. The machine is called a stator, because all moving machinery has been eliminated. Instead a small boiler contains mercury, and when it is heated and the mercury boils, the vapor is discharged into a venturi tube, sucking water vapor from the cooling unit and compressing it. Under the reduced pressure the remaining water rapidly evaporates, with resultant cooling. The heavy mercury flows back into the boiler and as it does so it pumps the water from the condensed water vapor back to its original height.

HOME-MADE talking movies, made at a cost of $12 as compared with a figure many times as much for the professional article, are being employed at the Medical College of Virginia, Richmond, Dr. Sidney S. Negus, professor of chemistry there, told members of the American Chemical Society meeting at Cincinnati in September. A 16 mm home motion picture camera is used, he said, to photograph the instructor writing chemical formulae on the blackboard. Then the pictures are subsequently run, and as they are run he talks into a microphone connected with a simple recording apparatus that makes a record on an aluminum disc. When the movies are shown to the students and at the same time the record is played on a phonograph, an effect of partial synchronization is obtained.

THE reported discovery of "ruins of a large stone city containing hundreds of buildings," about 100 miles from San Diego, has been investigated by Spencer L. Rogers, curator of anthropology of the San Diego Museum, who reported to *Science Service* that the stone "city" was built by nature and not by prehistoric Indians. The site with its irregular stone formations was once chosen by Indians as a convenient ready-made place for a habitation. This is shown by presence of numerous mortar holes in rocks and a wide distribution of potsherds over the surface. The site was discovered by Charles A. Davis, of San Diego.

SCIENCE NEWS

Science Service, Washington, D. C.

THE SPEED OF ROTATION OF STARS

BECAUSE a spinning star is both moving towards you and away from you at the same time, astronomers can now measure their speed of rotation, and have found many that turn at 40 miles a second, 150 times the speed of the earth at the equator.

This seemingly paradoxical effect occurs merely because one side of a turning sphere approaches while the opposite side recedes. Stand in front of a phonograph and watch the turntable as it revolves. If you drop a bit of paper or some small object on the right side, it will be carried towards you, but if you drop something else on the left side, it will be carried away from you at the same time. Then, of course, the first thing will go from you and the second towards you. Only if you were directly above the turntable, or if the phonograph were tilted so that you were on line with the axis of rotation, would all parts of the table remain constantly at the same distance.

This is an example of the principle used by C. T. Elvey, astronomer at the Yerkes Observatory of the University of Chicago, to measure how fast a number of stars are turning. The method was developed by a Russian and a German astronomer, also at the Yerkes Observatory, Dr. G. Shajn and Dr. Otto Struve.

Mr. Elvey has measured what is called the "contour" of a line with the instrument known as the recording microphotometer. In this instrument the spectrum plate is moved in front of a narrow slit through which a light shines. An electrical arrangement measures the amount of light which gets through and makes an automatic record by a moving spot of light on a strip of photographic paper. A single sharp narrow line makes a deep notch in the line on the paper after development. But if the spectrum line is broad and faint, it makes a flat "bay," broad and shallow. The "contour" of the line refers to its shape when recorded by the microphotometer. As the spectrum line of wave-length 4481 due to magnesium is ordinarily sharp and narrow, it is well adapted to such studies and was the one used by Mr. Elvey.

Of 59 stars that he has studied, the average surface speed is 60 kilometers (37 miles) a second. The sun, at its equator, turns only about 2 kilometers a second. Therefore, if these stars are the same diameter as the sun, which is of about average size, they turn about thirty times as fast, or about once in 24 hours. The sun is about 865,000 miles in diameter and turns once in about 28 days. At the equator of the earth the speed is only about 400 meters, or about a quarter of a mile, a second, because of its much smaller size.

These speeds for the stars are conservative, because Mr. Elvey has made no consideration of the effect of darkening at the limb of the star. Most of the star's light comes from the center as it faces us, the region which is not approaching or receding. This makes the broadening of the spectrum line less than if the light came with equal intensity from all parts of the star.

One star studied by Drs. Shajn and Struve is turning even faster. It is known as W Ursae Majoris, and is in the Great Bear. Though about three quarters as large as the sun, or 650,000 miles in diameter, it turns once in a third of a day.

THE CLAUDE OCEAN POWER PLANT

IT is not a house of mystery, this power plant that the famous French inventor and engineer, Georges Claude, has built on the ocean shore in Cuba. Now he is just about ready to test to find out if it will successfully and economically make the warm water of the surface and the cold water of the deep sea produce electrical energy.

Although some engineers have criticized the Frenchman's novel apparatus as being impractical and point to serious difficulties to be overcome, they admit that M. Claude's theory is sound.

The apparatus resembles closely the usual steam power plant that uses a fire to make its steam. But in the plant at Matanzas, there is no place for a fire. The highest temperature of any of the apparatus will be that of the incoming water from the surface of the ocean at about 80 degrees Fahrenheit. This enters the boiler or steam generator after passing through a de-gassing tank which removes the dissolved atmosphere and gases.

Water which comes from deep in the ocean and is 30 degrees cooler than that which enters the generator is brought to the condenser at the other end of the system. As in the ordinary steam power plant, it is used to condense the steam after it has passed from the generator through the turbine. This continuous process of condensation lowers the pressure in the boiler and causes more water to evaporate into steam and flow through the turbine into the condenser, where it is changed into water again.

Pressure in the usual steam boiler is measured in hundreds of pounds, while that in the Claude boiler will be less than the pressure of the atmosphere outside. Even this low pressure of the boiler will be higher than that of the condenser, because the steam must flow from the boiler through the turbine to the condenser in order to turn the blades of the turbine and produce power.

And this is where engineers accustomed to conventional power plants direct most of their criticism. Because the process involves relatively small changes of temperature and pressure, unusually large quantities of cool condensing water and warmer boiler water will be required. Will not a prohibitive amount of auxiliary power be required to pump this water? it is asked.

Also, because of the slight pressure differences on which the turbine operates, large quantities of steam must pass through it to produce a reasonable amount of power and the turbine will have to be unusually large to take care of this steam. These are serious problems

which some believe may make the Claude project impractical on a commercial scale.

On the other hand, M. Claude's record of achieving what others have called impossible should not be overlooked. He invented the first successful process for making liquid air and for liquefying other gases; he pioneered in the field of making liquid ammonia out of the atmosphere, and he is the inventor of glowing red neon lights that shine on our streets at night. Certainly, it is entirely probable that the experiments on the coast of Cuba may be the beginning of a series of great power plants that will revolutionize life in tropical countries.

ANIMAL DISEASES IN THE UNITED STATES

"THE United States is entirely free from such serious diseases of animals as rinderpest, contagious pleuropneumonia, surra and foot-and-mouth disease," according to a statement made by Dr. John R. Mohler, chief of the U. S. Bureau of Animal Industry, to the Inter-American Conference on Agriculture, Forestry and Animal Industry that met recently in Washington. Foot-and-mouth disease has been introduced occasionally but prompt slaughter of affected animals and disinfection of premises has quickly eradicated it.

Dr. Mohler told delegates to the conference how a national quarantine law should be drawn up to prevent introduction into a country of serious animal diseases. For instance, federal officials should be able to control not only the animals offered for entry into the country but also the materials generally closely associated with livestock, such as hay, straw, forage, meats, hides and other animal products. Some of the most dangerous animal diseases may be introduced into the country through the medium of such materials and products.

Plans for an inter-American cooperative clearing-house for the exchange of information on animal diseases and control measures were discussed. Such a clearinghouse would depend on the existence in each country of an efficient national livestock sanitary organization which could enforce suitable regulations for the control of animal diseases. Regular reports of the livestock disease situation should be sent by each country to the inter-American clearinghouse for the benefit of all member countries. Unusual disease outbreaks, such as those of a nature not previously known, should be reported by telegraph.

THE USE OF PULQUE BY MEXICAN INDIANS

PULQUE, a Mexican drink inherited from prehistoric times and for which prohibition has been urged because it is blamed for the degeneracy of the Indian, may have been keeping him alive this long, a nutritional investigation seems to indicate.

Under the direction of Dr. José Zozaya, director of the Hygienic Institute of Mexico City, studies are being made for the first time on foodstuffs used by the native population. The first material thus investigated was pulque, and the results show that this slightly intoxicating liquor is extremely rich in yeasts. The native diet on the central plateau where pulque is the great drink, consists mainly of chili, beans and corn, an unbalanced and incomplete ration in the light of what is now known of man's requirements.

Because of such a diet, rickets should be the prevalent disease of that region, but curiously enough crooked bones are rare and, in spite of extremely unhygienic living conditions, those that survive the infectious diseases of childhood grow surprisingly strong. The strong back of the pulque-drinker supplies most of the transportation in rural Mexico. Little Indian girls, hardly more than babies themselves, play games with the next youngest sister or brother slung on their backs in a rebozo. Small squatty brown boys can lift weights off the ground that are hard for grown white men to lift. Indian babies are often weaned on pulque, and as soon as they can walk they consume chili that would make a strong man cry.

What part "Alpine" sunlight on the high Mexican plateau plays in the prevention of Indian rickets is not known, but Dr. Zozaya is convinced that pulque, with its plentiful yeasts rich in the vitamins and amino acids than corn and beans lack, has probably served to keep the race alive, rather than killing it off. He finds that in spite of the very bad water supply of many pulque haciendas, intestinal infections there are rare.

Pulque is the fermented juice of the maguey, or century plant, which with the cactus is the most characteristic object on the Mexican landscape of the central plateau. Its leaves, like curved swords, sometimes grow ten feet long and several inches thick. Its importance was so fully appreciated by the ancient Mexicans before the Conquest that they had a patron-deity-in-chief of pulque, with many minor gods to assist.

Because of its undoubted nutritional value, as well as the enormous capital invested in the industry, Dr. Zozaya believes a hygienic control of the industry is what is indicated at this time, rather than prohibition.

THE ORIGIN OF CULTURE

A FIRST-HAND study of the artifacts left by early man leads to the conclusion that all the cultures of the world, even including that of the American Indian, are the result of a process of evolution and have some single origin. At least such is the judgment of Dr. H. S. Harrison, curator of the Horniman Museum, as expressed in a report just submitted to the British Association for the Advancement of Science.

Man is not capable, said Dr. Harrison, of inventing some previously unconceived instrument or method to fit an ideal purpose. "The plough," he said, "was not invented as a means of more efficient tillage, but was the result of the discovery that a pick or a hoe could be dragged through light soil so as to prepare a seed bed more rapidly than could be done by packing up the soil; the implement got a new start in life by a change in the method of use. . . . At no stage was there a premonitory

vision of a method of agriculture, or a type of plough, having an origin in a mental conception cut off from its roots in the state of knowledge of the place and time. That kind of unconditioned foresight does not happen even now-a-days, and we may assume it never will.'' Even man's purpose and desires are a result of the process of evolution, Dr. Harrison believes, and even the research worker in our modern laboratories is merely building upon the foundation of the past.

''Our artifacts, material and immaterial alike, have emerged from the interaction between mind and matter, and between mind and mind; they were not devised beforehand for material or social ends, but arose out of the rough-and-tumble of an environment that grew as knowledge grew and artifacts accumulated. Aims and ends evolved with the discovery and invention of ways and means. The artificial environment has expanded with the progress of civilization, but the human brain has not undergone a like inflation; nor, as far as can be seen, has the human mind undergone a change in its essential characters. It is still unable to form preconceptions of artifacts and processes that can not be built up in the mind's eye, on paper or in practice, by combining fact, methods and principles that are known, with the aid also of discoveries arrived at by experience and experiment. Only as man became capable of transmitting his knowledge to his offspring, by precept as well as by practice, could he create a cultural continuity extending over many generations.

Dr. Harrison urged his colleagues to follow the example of continental and American anthropologists in studying the material remains of early man at first hand in the field. He said: ''The hands of the anthropologist must come to the aid of the eyes and ears. Until he has done practical work of this kind, he is not even able to make the best use of the specimens he views through the windows of museum cases. It is now well known that ordinary glass denies a passage to some of the more active of the sun's rays, but it is not so fully understood that the light of knowledge is also much enfeebled by its filtering action.''

ITEMS

In an effort to replace the lost musk-ox herds of northern Alaska, the U. S. Department of Agriculture has arranged to import thirty of these valuable animals from Greenland. They will make a long detour on their way, for they are to be brought first to New York, thence by rail to Seattle, and finally by steamer and rail again to Fairbanks, Alaska. Representatives of the Bureau of Biological Survey, skilled in the handling of wild animals in transit, will accompany them all the way. The little herd will be an expensive one, for an appropriation of $40,000 has been set aside to cover the cost of its acquisition, transportation and establishment in the protected enclosure that will be its new home. But it is expected that the animals may eventually pay for themselves many times over, as the imported reindeer have done, by becoming the basis of a new meat-producing industry utilizing food plants that now go to waste. Alaska once had a fair number of musk-oxen in the northern part of the territory, but indiscriminate hunting by explorers, traders and natives with newly acquired firearms exterminated the herds.

Experiments conducted recently by the National Physical Laboratory indicate that imitation sunlight, shining through fake windows, aids and encourages belated clerks to turn out better work than they are able to do under the artificial stare of ordinary vacuum or gas-filled lamps. A comparison of the hourly work output of clerks working in simulated daylight with their efficiency under ordinary artificial lighting conditions showed a balance in favor of imitation daylight. Coloring of the light to approximate the sun's rays was found to be the most essential condition for efficiency, though the distribution of the light through a window-like aperture was also discovered preferable to illumination from semi-indirect bowls suspended from the ceiling.

Warning of the presence in the air of carbon monoxide and other deadly gases such as hydrogen sulfide may now be given by a chemical in a container similar in appearance to the first-aid ampuls of aromatic ammonia. This carbon dioxide detector has been tested and found satisfactory by the Pittsburgh Experiment Station of the U. S. Bureau of Mines. The little ampul may be carried by the workman going into garages, sewers, mines or other places where the air might be contaminated. When the outer covering is crushed, a white filter paper or wad of white cotton soaked in palladium chloride is exposed to the air. Palladium chloride is a light straw color and does not discolor the white cotton, but as soon as it meets carbon monoxide or several other poisonous gases, the palladium is freed and the cotton turns gray or black, the intensity of the black depending upon the amount of the poisonous gas present.

Limestone, or what will eventually be limestone, is manufactured in thousand-ton lots in shallow lakes in the Middle West. So much is indicated by researches conducted by Professor H. A. Schuette and Hugo Alder, of the University of Wisconsin and the Wisconsin Geological and Natural History Survey. The two chemists analyzed quantities of Chara, a water-weed that grows freely in the ponds and lakes of limestone regions. Its stems and leaves are harsh and rough to the touch, indicating the presence of considerable quantities of mineral. The analyses showed the sand-free, air-dry plants to contain over 41 per cent. of ash, of which much the larger proportion was calcium carbonate, captured out of solution in the lake water. In the lake where the analyzed samples were collected, about half the mass of the yearly crop of aquatic plants is accounted for by Chara. With this as a basis, Professor Schuette and Mr. Alder calculated that this one plant yearly returns to the bottom of this lake something like a thousand tons of calcium carbonate.

SCIENCE NEWS

Science Service, Washington, D. C.

SOURCE OF THE SUN'S ENERGY

ELECTRICITY, under a pressure of ten million volts, about the same as that of a good lightning flash, is constantly flowing from inside the sun into outside space, and so "heats the solar atmosphere to incandescence in a manner precisely as the filament of an electric light is heated by the electricity flowing through it." This is the new and startling theory that has been developed by Dr. Ross Gunn, research physicist of the U. S. Naval Research Laboratory. Dr. Gunn discussed these implications of his theory with a representative of *Science Service*. A full technical report of his conclusions will shortly appear in *The Physical Review*.

Dr. Gunn pointed out that the rotation of the sun is peculiar. Not only does its equator turn faster than regions near its poles, but the rotation of the same part varies by a few per cent. over a period of about six years. A similar regular change occurs in the amount of light that the sun gives off.

Dr. Gunn said: "Study of the electric and magnetic phenomena in the sun's atmosphere has led me to an explanation of these observed variations and given a great deal of valuable numerical information. I don't need to go into technical details, but the way that we have observed the sun to rotate requires us to believe that it is constantly throwing off large amounts of electricity. This current is so large that it wouldn't mean much to the layman for me to express it in numbers, but the sun is caused to glow by a voltage equivalent to a good lightning discharge, about ten million. It is this continually flowing current that heats up the sun like the filament of an electric light, so we might say that the sun acts like a gigantic electric light radiating its energy into space. It is the ultimate power house and stimulant of the solar system.

"We can also calculate the total power required to light the solar electric lamp. The entire wealth of our nation would buy enough electricity, at present rates, to light the sun for a millionth of a second. Yet the sun has been burning this way for at least a million million years, and perhaps longer, so you might ask where the energy comes from.

"The latest researches seem to answer this question and it seems almost certain that the energy comes ultimately from the annihilation of matter. In the past few years physicists have come to believe that mass and energy are the same thing in different forms. Therefore, if processes take place in the sun which cause mass to vanish and light or electrical energy to appear, we need not be greatly surprised. This view is consistent with many other known astronomical facts. It is fairly certain that by means of some subatomic process the sun converts a million tons of its material into energy every second.

"This loss of mass is very great, but it is small compared with the sun's total mass. It is estimated that not until a million million years have elapsed will its size be appreciably affected. Therefore, it seems likely that the sun will continue to shine as it does now for a great many generations, unless some new phenomenon appears and upsets the domestic economy of the old Egyptian god!"

RADIO RECEPTION

GOOD radio reception of broadcasting stations, accompanied by few sun-spots, is predicted for the coming fall months by Dr. Harlan T. Stetson, director of the Perkins Observatory at Ohio Wesleyan University. A detailed report of his findings will appear in the forthcoming issue of *The Journal of the Franklin Institute*, published in Philadelphia. By the time winter commences, however, there will be a general increase in the number of sun-spots, which will be associated with somewhat poorer reception of broadcasting stations.

But even though the spots will be slightly more numerous than now, we shall then be so far past the maximum in 1928 and 1929 of the eleven-year solar cycle that radio will not be affected nearly as much as in those years. After that the spots will become still less frequent, and by "1934 solar activity should be as quiescent as at the last minimum in 1923."

Dr. Stetson warns against trying to blame too much on sun-spots, however.

"The mention of sun-spots invariably raises the question of a possible connection between spots on the sun and terrestrial phenomena," he says. "Some statisticians with an insatiable appetite for correlations have attempted to connect with sun-spots almost every cycle in world affairs from fluctuations in the New York stock market to the fecundity of rabbits in northern Canada. In the popular mind almost every world catastrophe has sooner or later been attributed to sun-spots, from a Florida hurricane to the great World War, both of which, by the way, did culminate around a sun-spot maximum."

However, Dr. Stetson points out, there are some phenomena which have definitely been shown to be related to sun-spots, such as magnetism, displays of the northern lights and radio reception. By means of a series of measurements since 1926 of the reception of station WBBM, in Chicago, as received in Massachusetts first, and now in Ohio as well, it was demonstrated that "long distance night reception in the broadcast zone is in general poor when sun-spots are numerous, and good when the spots are few."

Dr. Stetson found that in addition to the eleven-year cycle of sun-spots there is a smaller period of about fifteen months, and that there is an exactly similar period of variation in the radio reception. In December, 1928, he predicted a marked increase in sun-spots in September or October, 1929, a prediction which was entirely fulfilled. The next maximum will thus come next winter, but because we are so well past the maximum of the great eleven-year cycle, the spots will probably not be very numerous, and so radio reception will not be greatly affected. Thus it may be that we will have a

return to the excellent conditions for long distance radio reception enjoyed in 1923, when radio was first coming into popularity.

NEW TECHNIQUE FOR THE STUDY OF LIVING TISSUE

A METHOD which enables scientists for the first time to study over a long period the microscopic details of the growth of living tissue in a warm-blooded animal has been developed in the laboratory of anatomy at the University of Pennsylvania's School of Medicine.

Through its use, the cellular changes in living tissues can be studied as by no other method, and fundamental information regarding the manner in which abnormal cellular reactions occur in infectious diseases like tuberculosis and in tumor growth like cancer will be obtainable.

That such cellular reactions occur has long been known by the end results seen in these diseases, but by enabling the observer actually to see the entire process of cell changes the new method opens the door to enormous advances in knowledge.

The method, for whose rapid perfection and extension the Rockefeller Foundation has made a $75,000 grant to the university, consists of the introduction of a transparent, double-walled chamber, or "window," into a small hole made in the ear of a rabbit, the perforation being made in much the same manner as the human ear is pierced for the wearing of certain types of earrings.

One side of this "window" is of celluloid or glass, and the other of a very thin sheet of mica. The edges of the space intervening are left in contact with the tissues of the ear and from them the blood vessels and other living tissues invade the chamber until they form a complete new layer.

This new layer, only two thousandths of an inch in thickness, is quite transparent and it is necessary only to place the "window" under the microscope to see with the most extraordinary clearness at 1,000-fold magnifications the minutest elements—the individual cells—of which animals are made.

Moreover, since the new tissue is permanent and the chambers can remain in place for months without causing discomfort to the animal, it is possible to make repeated observations and careful studies not only of the exact way in which the new growth occurs, but also of the way the tissue elements behave in conditions of health and disease.

Heretofore there had been no satisfactory region in a warm-blooded animal in which such fine details could be studied on living, growing cells inside the body. Investigators depended either on cutting thin pieces of dead tissue, staining them in various ways, and placing them on glass slides in order to study tissues and cells under the microscopes, or on keeping small pieces of tissue alive in "tissue cultures" outside the body.

The development of the new method grew out of a number of research projects in which Dr. Eliot R. Clark, professor of anatomy at the university and director of the anatomical laboratory, had engaged, and in many of which he collaborated with his wife, Eleanor L. Clark.

VITAMIN A FROM CAROTIN

EVIDENCE that animals can manufacture the growth-promoting vitamin A in their bodies from carotin, the yellow coloring matter of some of their foods, has been reported to the Medical Research Council by Dr. Thomas Moore, of the Nutrition Laboratory at Cambridge. Dr. Moore's discovery reverses an earlier theory about vitamin A, that it is not made by the animal and that all of it found in animal bodies and glands comes directly from the food eaten.

Vitamin A, besides promoting normal growth, increases resistance to disease. It is found in animal fats, such as butter and beef fat, in eggs, milk and vegetables. It has always been found together with this yellow pigment, carotin. The yellow of the egg, butter, yellow carrots and yellow corn contain this vitamin. White corn, white carrots and white turnips, however, have very little vitamin A compared to the amount found in the yellow varieties. In green vegetables which contain this vitamin, carotin is also present but its color is hidden by the green color of chlorophyll which is abundant in such plants.

Not only do the two substances occur together but carotin has the same effect on growth and bodily vigor and health as vitamin A. Extracts of pure carotin can cure animals suffering from deficiency of vitamin A just as feeding the vitamin could cure them.

Chemical tests show that the two substances are not identical and investigators were at a loss to explain the matter until Dr. Moore showed that the carotin or some part of it is changed into vitamin A in the animal's body.

Dr. Moore fed rats on a diet lacking vitamin A until all the excess of this vitamin which they had stored in their livers and elsewhere in their bodies was used up. Then he fed them carotin in as pure an extract as he could get. The rats, which had been weak and sickly, recovered, and when a large amount of carotin had been fed, examination of their livers showed that they again had stored up some vitamin A.

AGE OF EXTINCT CHINESE ANIMALS EXTENDED MILLIONS OF YEARS

ACCORDING to a cable to *Science Service* from H. J. Timperley, Peiping, the family trees of two queer but extinct animals of the ancient eras of the earth were extended deeper into the past by the Central Asiatic Expedition under the leadership of Roy Chapman Andrews which has just returned to Peiping after five months' intensive scientific exploration of the Gobi Desert.

No trace of primitive man, one of the hopes of the expedition, was unearthed, but a large and important collection of fossils was secured, representing about seventy-five different species of animals, several new to science.

Skeletons of the coryphodon, a creature unlike any now living on earth, were found in strata of the earth of the Oligocene period, which extends the period of evolution of this animal several millions of years into the

past. The coryphodon was somewhat like a rhinoceros, but not a relative. It had feet built on the pattern of an elephant, however, with five toes. The bones of this vegetarian animal brought to Peiping by this expedition of the American Museum of Natural History are far older than any coryphodon fossils found in America.

Skulls and jaws of another group of extinct animals, called calicotheres, much more primitive than the types found in Europe and America, are also contained in the collections. These creatures had teeth like the moose and elk of to-day, lived on a vegetable diet, had long forelegs and five toes with compressed hoofs that had the appearance of claws and may have been used to tear food or enemies.

Among the new genera found were several titanotheres, extinct cousins of the rhinoceros, and new kinds of true rhinoceroses, deer, antelopes and rodents.

Dr. Andrews declared that he hopes to continue his search for primitive man upon another expedition next summer.

PUBLIC HEALTH IN A CHINESE COUNTY

AT least one rural county of disease-ridden China is to have modern doctors and nurses and a real health department and the 400,000 inhabitants will be given a chance for healthier, longer lives, according to a report to the Milbank Memorial Fund.

The county of Ting Hsien in the interior of China has been made the subject of a rural health experiment, which is part of the Chinese National Association of the Mass Education Movement. Many such experiments have been successfully conducted in America, but the experiment in China will be made under conditions hard to picture, the political unrest being merely one of the many difficulties to be met.

In the entire county of 400,000 people, there is not one physician of the modern scientific school. The native doctors believe disease is caused by heat and wind. Sanitation is unknown. Nine tenths of the people are unable to read or write. Nearly all of them are ignorant, superstitious and poor. Eighty thousand live in the county's one city, the rest huddling in the squalid, mud-hut villages. About 30 out of every thousand die each year, while the life expectation is only about 35 years.

The health demonstration has begun by educating the natives to come for examination and to accept medical advice and treatment. Vital statistics are being collected and native nurses, midwives and physicians are being trained in modern scientific methods. The head of the Ting Hsien Health Department is Dr. H. H. Yao. The Milbank Memorial Fund has given $50,000 to aid in the work.

The present time is considered particularly opportune for this movement in spite of the political situation, because it is hoped that this non-political organization may lay the foundation for more effective governmental activities when the political situation is once more stabilized. The League of Nations has announced that it will support and cooperate in attempts to modernize China's health service despite the country's seeming preoccupation with civil war.

ITEMS

FOSSILS of Sinanthropus, the so-called "Peking man," found near Peiping within the past year will provide the most valuable clue yet unearthed for solving the riddle of early man, was the prediction of Professor G. Elliot Smith, noted British anthropologist, in a recent lecture before the Chinese Geological Society. Professor Smith is in Peiping at the invitation of the Chinese Government for the purpose of studying the Sinanthropus specimens, including the skull of the Peking man found last year and a second skull recently discovered. Although the report on the cast of the brain case obtained from the second skull is not complete, Professor Smith described the discoveries as unique in the whole history of anthropology and predicted that the evidence would throw a flood of light on the nature of the primitive brain.

USE of the airplane for scouting fishes has been successful in many places. Aviator Frank Dorbandt while flying high above Cook's Inlet recently saw fully a thousand whales play and sport in the sea under him and to assure himself of their numbers he circled over them several times. Spouting, rolling and diving, the whales seemed given more to basking in the sun than to seeking or pursuing any species of food fish. Some kinds of whales migrate in late summer to the south and it is possible the pilot noted one of these movements.

THE natural fruit colors of certain canned fruits are preserved much better when the cans are kept in cold storage than when they are kept at ordinary temperatures. T. N. Morris and J. M. Bryan, of the Low Temperature Station, Cambridge, have recently found that canned strawberries stored for three months at a temperature just above freezing have a fine red color, whereas those kept at 10 degrees below zero Fahrenheit are pale, and those stored at ordinary room temperature are also somewhat pale. The strawberries from cans stored at just above freezing actually had a much better appearance than when they were first canned because the color had returned to the fruit from the syrup.

THE ferns of the Hawaiian Islands are furnishing data toward the eventual solution of the tangled puzzle of the archipelago's geological history. This is the opinion of Dr. E. D. W. Brown, a woman botanist who has done much work in Hawaii. "We are now beginning to compare the migration of spore-bearing plants in the Pacific area with that of the seed plants," she said recently. "It seems that we should expect little or no endemism in the ferns, since the dust-like fineness of the spores would seem to adapt them particularly well for wide distribution by hurricanes and violent winds or even by slow-moving air currents; and it is a matter of considerable surprise to find how many species of ferns and fern allies are confined to local areas. Instead of being distributed in the paths of the trade winds, seemingly their migration has been nearly as dependent upon the emergence and submergence of the islands of the ocean and the attendant factors favoring plant dispersal as that of the seed plants."

SCIENCE NEWS

Science Service, Washington, D. C.

THE AMERICAN COLLEGE OF SURGEONS

A PLEA to save the practice of surgery from becoming too much of a product of the machine age was voiced by Dr. C. Jeff Miller, of New Orleans, in his presidential address before the first general session of the annual clinical congress of the American College of Surgeons meeting in Philadelphia on October 12. The virus of standardization, characteristic of present-day American civilization, has infected American medicine, he said. Hospitals, medical schools, laboratory methods and medical and surgical treatments have been standardized and in many respects the patients are better off as a result. But there is a limit to standardization. Medicine and surgery have now reached this limit. Hand in hand with accurate diagnosis and scientific treatment should go sympathy and kindliness and pitifulness on the part of the physician, which will awaken faith, hope and trust on the part of the patient. "No amount of scientific efficiency can take the place of kindliness and pitifulness when the darker hours come on and we enrich ourselves by giving of them freely."

THE same thought was emphasized by Professor George Grey Turner, of Newcastle-upon-Tyne, England, in his John B. Murphy oration later in the evening. Routine, standardized operations he deplored. One should suit the surgical procedure to the patient. This depends on a thorough knowledge of the structure of the human body and of the changes brought about by disease. The surgeon should not depend entirely on routine, but should be guided in his methods by the conditions he finds as he operates on each patient. He paid high tribute to the famous American surgeon in whose honor a surgical oration is given each year at the annual congress of the American College of Surgeons. While improvements in methods have been achieved since Murphy's original contributions, his teachings should still guide modern surgeons. Appendicitis, for instance, is still a serious condition which might often be more successfully treated if physicians remembered Murphy's dictum, "Get in fast and get out faster." Professor Turner said that the first part of this saying was not meant to license indiscriminate operations, but to insure early diagnosis. The last part was to impress surgeons that a thorough cleaning and swabbing of the abdomen then customary was not necessary. Professor Turner also reported some encouraging results of operative treatment of cancer.

APPLICANTS for jobs in the hazardous occupations should be given examinations showing their temperaments and adaptability as well as their physical condition, according to Dr. George W. Swift, of Seattle, Washington. Persons of what physicians call psychopathic constitutions, meaning those whose nervous, mental and personality make-ups are abnormal or unstable, should not be given work in dangerous occupations, because the slightest injuries to such people are apt to result in claims for complete and total disability. Dr. Swift discussed particularly the types of head injuries seen in the practice of industrial surgery. One third of them fall into the group of minor injuries, he said. In another third the patients will have perfectly obvious permanent disabilities. The remaining third is composed of patients who after a period of time do not adjust themselves to their condition. These cause the greatest difficulty in compensation work. The task of determining which of these patients still have physical disability due to their injury and which are unable to adjust because of nervous or mental instability is extremely difficult. Dr. Swift advised the study of all brain injuries by ventriculography. By this method air is injected into the brain cavities and X-ray studies are made. The presence of brain tumors may be detected by this means. Such a study will enable physicians to give the injury better treatment from the beginning and thus prevent many actual physical disabilities.

"CANCER is to-day a greater menace, a more formidable scourge, than any other malady threatening our national life, with the exceptions of crime and the drink habit," according to Dr. Howard A. Kelly, of Baltimore. "With all our efforts, experimentations and investigations, we are as yet far removed from any worth-while knowledge of the ultimate cause or causes of this dread enemy. We do, however, know a few helpful things about it. First, we know it is not contagious. Second, like every other ill in life it is most successfully treated in its earliest stages when it is a purely local affair. Finally, we know certain preventive measures which can be taken. The golden rule of prevention is to look upon every persistent sore or lump in the skin, breast, mouth or any accessible part of the body as potentially serious until a competent doctor or surgeon declares otherwise." Any unusual condition should be investigated at once. Delay is dangerous. "The sad habit of watching lumps or lesions until their nature becomes obvious and both doctor and patient are at length persuaded that something ought to be done is responsible for the loss of many precious lives."

A MATHEMATICAL study of the tensile strength of wounds, their ability to resist strain or rupture, was reported by Dr. John D. Ellis, of Chicago. The study was part of a comparison of the healing of surgical and electrosurgical wounds. Cuts were made with a knife or scalpel, and specimens of the wounds, a small fraction of an inch each, were pulled apart and their tensile strength recorded in grams, or fractions of pounds. Less than two thirds, or 60 per cent., of the wounds made by electrosurgery healed by what surgeons call primary intention, as compared with 97½ per cent. of the wounds made by the scalpel. Furthermore, the electrosurgical wounds did not develop the tensile strength of the scalpel wounds for 21 days.

ELECTROSURGERY has its greatest usefulness in the removal of malignant diseases or cancer, Dr. Oscar E. Nadeau, of Chicago, said at the same session, which was a symposium on electrosurgery. In his clinic at the Augustana Hospital, the electrosurgical knife has been used more for removing cancer of the breast than for any other operation. Because of the sparks from the electrosurgical needle or knife, ethylene gas or other explosive anesthetics can not be used. Successful use of this method in operations for goiter was reported by Dr. Martin B. Tinker, of Ithaca, N. Y.

THE application of electrosurgery to surgery of the brain and nervous system makes the third great advance that has been made in the field of neuro-surgery, according to Dr. Ernest Sachs, of St. Louis. By its means, brain tumors that were formerly considered inoperable can now be dealt with and other types of brain tumors can be removed more safely than before. The technic of the method takes time to learn, and Dr. Sachs prophesied, that more and more will be accomplished with it in the future as surgeons become increasingly familiar with it and learn to realize its possibilities.

A MIMEOGRAPHED list of directions for ten exercises designed to teach walking is part of the treatment for broken bones of the leg as described by Dr. John S. Coulter, of Chicago, at the conference on traumatic surgery. When both bones of the leg are broken, there is a long period of inaction which impairs the power of muscle coordination. After the leg has been in a cast for three weeks or so, the patient needs to be taught how to walk again, and should be given exercises before being allowed to put his full weight on the injured leg. The walking lessons need entail no extra expense to the patient, and he can teach himself with the aid of the mimeographed instruction sheet. In this type of case, physical therapy is not only a valuable aid but an essential one. Dr. Coulter also told surgeons how heat, light, water, massage and exercise should be used to help in restoring function of the leg.

THE rapid increase in the number of fractures or broken bones during recent years is due to the increase in the use of automobiles, Dr. Samuel R. Cunningham, of Oklahoma City, said. "Thirty years ago in a city of 200,000 population we did not see as many fractures from all causes as we see now in a city of similar size resulting directly or indirectly from motor cars." Surgeons need to direct more attention to learning how to treat fractures satisfactorily, he added. The treatment of diphtheria or appendicitis has become fairly well standardized, but the treatment of simple or complicated fractures is not generally so well understood.

THE hospitals of the country have been seriously affected by the increasing number of motor vehicle accidents, according to Emil Frankel, director of research of the New Jersey department of institutions and agencies at Trenton, N. J. General hospitals of the United States had during 1929 between 200,000 and 250,000 in patients who had been victims of highway accidents. The cost of their hospital maintenance was between $15,000,000 and $16,000,000. The hospitals lost between $5,000,000 and $6,000,000 from patients of this kind not paying their bills. Eventually the community must pay for the patients who do not and who thus become charity cases. In one hospital, 251 patients were brought in from 114 highway accidents. The number of such accidents is increasing everywhere as the number of motor car owners and motor bus users increases.

ROTATION OF THE PLANETS

WITH the discovery by Dr. J. H. Moore, Lick Observatory astronomer, that the planet Neptune turns once on its axis in about 16 hours, there remain only two of the larger members of the solar system for which the day is still unknown. Venus, which becomes brighter than any of the other planets and which has been so conspicuous in the western evening twilight in recent months, is one. The other is the newly discovered Pluto, which represents the main contribution of 1930 to the history of astronomy, and which can only be discerned with the aid of a large observatory telescope.

It was the spectroscope, which analyzes the light of a star to tell what it is made of and how it is moving, that revealed to Dr. Moore the secret of Neptune's rotation. The light from the planets is reflected sunlight. Therefore, the spectrum shows the dark lines crossing it that are characteristic of the spectrum of sunlight, the lines being caused by vapors of certain elements absorbing certain colors in the sun's light as it passes through the outer layer of that body.

If light from a star or planet that is approaching the earth is analyzed through the spectroscope, it is found that the lines are slightly displaced, towards the violet end of the colored spectrum. If the star is receding, on the other hand, they are shifted to the red end. This is because the waves are squeezed together and made shorter in the first case, while in the latter instance they are spread out and made longer. It is the length of the wave that determines color of light, so light from a rapidly approaching source is bluer and from a rapidly receding source redder than one that is standing still.

Dr. Moore photographed the spectrum of the light from Neptune along a line crossing the planet's disc from east to west. The spectrum photographs showed the lines tilted, rather than displaced in their entirety to one end or the other. This indicates, of course, that one side of the planet is approaching the earth and the other side receding, in other words, that it is rotating. As the side of the lines made of light from the eastern edge tilted to the violet, it showed that the eastern side of the planet is approaching us. That is, the planet turns from west to east, like the earth, and all the known planets except Uranus.

The faster the planet turned, the greater would be the tilt, so from a determination of the angles of the lines, Dr. Moore was able to measure the period of rotation,

or "day" of Neptune. This came out as 15.8 hours, though he admits that there is a possible error in this figure of as much as an hour, either too fast or too slow.

Dr. Moore also has measured the day of Uranus. In 1911 Drs. Percival Lowell and V. M. Slipher, at the Lowell Observatory in Arizona, found by a similar spectroscopic method that Uranus rotates once in 10¾ hours, and that the planet turns from east to west, unlike all the other members of the solar system. Dr. Moore has confirmed the direction of the planet's rotation, but gets slightly different values for the rotation with different sets of spectrum photographs. One set, made with a smaller spectrograph, gives values like those of Lowell's, but another set, made with a more powerful instrument, gives about 11.5 hours. The latter photographs, however, are not fully exposed, and were difficult to measure. Dr. Moore said that the discrepancy is probably due to the small images of the planets, as a result of which such determinations are at best only approximations.

For the other planets, Mercury has a day of 88 of our days, the same as its rotation period around the sun, so that it always keeps the same face towards the sun. The period of Venus is uncertain, because it seems to be constantly covered with clouds that keep astronomers from ever seeing its surface, even though it comes closer and is sometimes brighter than any other planet. Spectroscopic observations show that it is very slow, probably more than 20 days, but as measurable heat is radiated from the dark side of the planet, it probably does not keep the same side to the sun. Therefore, its day is probably between 20 days and 225 days, its period of rotation around the sun. Mars, next of the planets to the earth, turns once in 24 hours and 37 minutes, only a little longer than the earth. Jupiter, largest of the planets, also has the fastest rotation period, for its day is only 9 hours and 55 minutes in length. Saturn, second largest planet, is almost as fast, with 10 hours and 14 minutes. Pluto's rotation period is not known, and, since it is so faint and its disc so minute, it is doubtful whether its period can be measured by methods in use to-day.

ITEMS

THIRTY new Pueblo sites have been unearthed in southeastern Arizona by Professor Carl O. Sauer, of the department of geography of the University of California. The villages were all situated on the gentle slopes at the base of the mountains where the summer floods could be best utilized for farming. There has clearly been very little change in climatic conditions during the intervening centuries. The complete defenselessness of the location indicates that the Chiricahua Pueblos date back to a more peaceful period than do the walled towns of New Mexico. The houses were for the most part built with their floors two or three feet below the level of the ground, anticipating the pit houses of a later period.

JAPAN would unite with the United States and any other country to protect the various species of whales for a number of years in order that the mammals might be studied and given a chance to multiply. Japan complains about the continued diminished whale products in her country, according to representatives of fish exporting firms at Seattle, Washington, who sell whale tails and canned whale meat in the Orient. In Japan the gray whale has disappeared. There has been a noticeable decrease year after year of right, fin-back and hump-back mammals found in the sea adjacent to the island empire. Japanese whalers have been forced to take long voyages into the Arctic and far south into the Antarctic to seek supplies for their industries.

THE bats which live and hibernate in one end of Carlsbad Caverns, estimated at three million in numbers, have not been giving their usual spectacular flights recently. Two reasons are advanced for this. One is that the extremely dry weather of the past season has caused a scarcity of night-flying insects, the other is that they have been disturbed by work going on in a nearby guano mine. Occasionally, however, they stream forth in great numbers, their flight from the cave opening lasting for several hours. An interesting feature of the bat exodus is that although they always fly south when they emerge from the cavern, they invariably return next morning from the north.

THE greatest recession ever recorded for the Nisqually Glacier, in Mount Rainier National Park, occurred during the past year when it retreated 118 feet. Records of the rate of recession of the Nisqually Glacier have been kept for 73 years. Last year it moved only 52 feet. The previous record recession was 106 feet, in 1921. Each of the 28 glaciers making up Mount Rainier's great single-peak glacier system is known to be retreating each year, due to the heat of the sun and to lack of sufficient snowfall to replenish the melted ice. The Nisqually, however, is the only one that has been measured annually and records kept. Two other glaciers, the Emmons and Carbon, were measured this year and records of these will be kept in the future.

WITH an average of 798 pounds of fertilizer used on every acre of crop land during 1929, Florida leads the United States in the use of fertilizer, according to R. O. E. Davis, research chemist of the U. S. Bureau of Chemistry and Soils, speaking to members of the American Chemical Society. Next to Florida is New Jersey with 417 pounds per acre. On the whole, the states of the Atlantic seaboard use it much more extensively than those inland, though a great increase in its use has come since 1913 in the Pacific Coast states, and there is also a tendency to increased use in the West North Central states. Cotton uses on an average 108 pounds per acre, though 31 per cent. of all the fertilizer used is on this crop. On citrus fruits the rate is 1,163 pounds. Five principal crops consume about 82 per cent. of the fertilizer, though less than 25 per cent. of the acreage devoted to them is fertilized.

SCIENCE NEWS

Science Service, Washington, D. C.

THE SOLAR ECLIPSE

By Professor Samuel A. Mitchell

Director, McCormick Observatory, University of Virginia, scientific head U. S. Naval Observatory Eclipse Expedition to the South Pacific

Niuafou Island, October 22.—Luck was with us. It rained during the night and again only two hours before totality, but it cleared in time and the total eclipse of the sun that we have traveled thousands of miles to observe was seen through clear skies with a very slight haze. The entire program was carried through successfully, though of course the photographs we took here today will provide material for study for many months after we return to the States.

The sun's corona, which flashed out around the dark disc of the moon during totality, was of the medium type that is to be expected at such a time as this, when we are about half-way between a time of maximum sun-spots and one of minimum. Two pronounced streamers of the corona projected out from the glow which completely surrounded the sun. We also saw half a dozen prominences, red flames of hydrogen, but none of these was very large.

At both the beginning and end of the total eclipse, the Bailey's beads appeared, resulting from the last sliver of sunlight shining out through valleys along the edge of the moon. The shadow bands appeared also on the earth's surface before the beginning and after the end of totality. These dark ripples were about an inch wide and about eight inches apart. They traveled over the earth at a speed of twelve miles an hour in a north-northwest direction. No bands were seen during totality.

We were also interested in watching the natives of this little island as the magnificent spectacle of a total eclipse appeared in the heavens. They were interested in it, but were quiet and did not seem to be frightened.

This is the eighth eclipse expedition that I have participated in, and the seventh eclipse that I have seen, for in Norway, in 1927, on my seventh expedition, my luck failed, and clouds prevented any observations. Before this trip I traveled about sixty thousand miles for eclipse observations, but had only seen the sun eclipsed for a paltry fifteen minutes all together. Now I have seen it eclipsed for about a minute and a half longer. This eclipse was not quite as long as we had expected, for the beginning was on time, but the end was a bit early. Such slight deviations from prediction, however, are to be expected.

Mrs. Mitchell and I came here by way of San Francisco, but we shall keep on going around the world, returning by way of Europe and New York early in January. Other members of our party, however, will return by the more direct route. Dr. Adams and members of the New Zealand party, who also had complete success, will return home as soon as they can dismantle their apparatus.

Niuafou Island, October 24.—Photographs of marvelous beauty, showing the sun's corona during the eclipse of this week with great detail, have rewarded the weeks of preparation and effort in connection with the American expedition's eclipse observations here on Tin Can Island.

We have just developed many of the photographs taken during the short period of totality and they confirm our feeling that this expedition's success has been unequaled in astronomical annals. The development of photographs on this tropical island with no running water and even with little water of any kind has been a difficult task.

Professor R. W. Marriott, of Sproul Observatory, who had charge of corona cameras, has now developed most of the coronal photographs, and the sixty-three-foot tower and the sixty-five-foot horizontal telescope took pictures of great beauty. The smaller cameras also gave splendid negatives. The photographs show that the corona exhibited streamers to the east and west and that it was midway in shape between the coronas characteristic of maximum and minimum sun-spot periods. An interesting coronal dome shaped like a gigantic strawberry is a prominent feature of all the photographs.

Last night I spent the whole night from dark to daylight in developing the spectrogram taken with two powerful concave gratings. The photographs show exquisite definition from thirty-two hundred ångstrom units in the violet region of the spectrum to seventy-eight hundred in the red portion. More than thirty lines of the hydrogen series exhibit themselves and these spectra contain eight coronal lines. The green coronium lines show exquisite structure and details a coronal disturbance agreeing in position but differing in shape from a prominence.

Our observations of time carefully computed show that the moon arrived early, the eclipse beginning two seconds earlier than calculated in advance and ending half a second early.

The spectra photographs taken by the New Zealand party showed good definition from the blue to the red region and the dispersion of the spectra taken with their prismatic camera is about one tenth that secured by instruments.

TELEVISION FROM A COLOR MOVIE

Television from color movie film, with all the colors reproduced; a method of securing television reproduction of fine detail without the use of extraordinarily wide frequency bands, either by radio or wire; and improved reproduction of color values in two-way television: these are some of the latest advances made by investigators at the Bell Telephone Laboratories. Speaking at the meeting of the Optical Society of America, held at the University of Virginia on October 30, Dr. Herbert E. Ives, under whose supervision the researches have been carried out, told of these new wonders.

The transmission of color movie film is done with the Kodacolor process, used in amateur 16-millimeter

movie cameras. In this process a series of minute ridges running the length of the film yields a positive film in which the image is made up of a series of fine horizontal lines. The position of these lines with respect to the ridges determines the color which they show on the screen. This is because the ridges act as cylindrical lenses and direct the light for the screen picture through one or more of three vertical color filters placed before the lens.

For the television arrangement, a scanning disc, with a series of fine holes, rotates in front of the film as it moves in front of a light. Then a lens projects the image on to three photoelectric cells side by side. No color filters are used, but the cells are arranged so that one picks up the red image, one the green and one the blue. In the television receiver, which is the same as that used in previous experiments in transmitting color images from real subjects, the current from each of these cells is fed into a glow lamp which reproduces the original color. The light from these three lamps is combined, and so the eye sees the reproduced image in full color.

One of the chief limitations of television, either in color or monochrome, and particularly when transmitted by radio, is the broad band of frequencies required. In radio work, the ten kilocycle band used for broadcasting, that gives ample width for sound reproduction, is much too narrow. Even the hundred kilocycle band, now authorized by the Federal Radio Commission for experimental use, is only sufficient to give a picture showing as much detail as a small newspaper halftone picture.

Dr. Ives described experiments, made with wire transmission, by which the original wide frequency band is divided into three bands, each of which is transmitted separately and recombined in the receiver. With this method, he said, an image made of 13,000 elements was obtained. This would be about as good as a newspaper halftone picture two inches square. Many technical difficulties are introduced by this method, however, for the characteristics of the three channels must be very carefully matched, or the recombination of the three sections can not be effected successfully.

The improvement in the two-way television is to illuminate the subject with a moving spot of red and blue light, instead of blue light alone, as used at first. With only blue light a result is obtained similar to that in photographs made with ordinary film without the use of a color filter. Even bright reds appear black, and yellow appears dark gray. With the two-color scanning, the reproduction, though in a single color, gives brightnesses more accurately corresponding to their actual value. This is possible because of the use of photoelectric cells of caesium oxide in conjunction with the ordinary potassium cells. The former are sensitive to red and the latter to blue. The booth is illuminated with yellow green light to which neither is sensitive.

BOTULISM IN THE UNITED STATES

A DEFINITE increase in the number of cases of botulism has occurred during the past two years, Dr. K. F. Meyer, director of the Hooper Foundation for Medical Research of the University of California, reported to the American Public Health Association at its recent meeting at Fort Worth, Texas. With the exception of two cases of botulism traced to shallots packed in Italy, home preserved vegetables, fruits, fish and meats have been the products responsible for the cases of poisoning in the recent outbreaks.

Botulism is a type of food poisoning caused by the presence in the food of an organism called *Clostridium botulinum*. This organism liberates a very powerful poison which causes illness and often death in persons eating infected food. Certain types of food are particularly apt to contain the organism, and home canned or preserved foods are more apt to have it now than commercial products.

"Commercially preserved food has not been connected with any of the recognized cases of botulism since 1925," Dr. Meyer said. Scientific canning procedures have replaced guess work in every branch of the industry which packs food liable to botulinus spoilage.

The moisture content of the food is an important factor in the number of deaths from this poisoning, Dr. Meyer explained. Meat and fish products in the form of pastes, soft sausages of the mettwurst variety and pickled fish have caused a larger number of deaths than hams or other relatively dry pork products in which the poison is unevenly distributed. About 88 per cent., or nearly nine tenths, of the intoxications observed in the United States were caused by vegetables of various sorts preserved in brine.

Plant products were involved in about three fourths of the cases in 192 outbreaks. Animal products were involved in less than one fifth.

"Home canned string beans continue to play a very important rôle, due largely to the well-known fact that spoilage of this vegetable when preserved is so slight that the housewife or cook will often fail to detect it. Furthermore, string beans are often served in salads and any odor which might arouse suspicion is usually masked by the vinegar or mayonnaise dressing," he stated. "Home canned corn has also been a frequent offender. From the public health standpoint it is imperative that the principles developed by the canning industry be applied to the methods of home canning."

All canning methods, whether commercial or at home, should aim at absolute sterility of the product to insure freedom from the organisms of botulism.

The rural sections of California, Washington and Colorado seem to furnish the majority of cases of botulism, while New York stands fourth, and Oregon, Idaho, Montana, North Dakota and Wyoming have recently contributed their share.

The spores from which the organism develops are found in the soil throughout the United States, England, Germany and France. The food acquires its dangerous botulinogenous properties from the soil and also probably from fecal contamination by animals, recent observations showing that certain varieties of the organism are found in the intestinal canal of animals.

AN AMERICAN "STONEHENGE" IN COLORADO

INDIANS in Colorado long ago constructed for their religious rites mysterious circles of stones that call to mind the great stone circle at Stonehenge in England, is the discovery by Professor E. B. Renaud, of the University of Denver, as the result of an expedition on behalf of *Science Service*.

Professor Renaud, who made a long, difficult journey over prairie trails to investigate the local rumor of an Indian fort, found that the "fort" was really a series of circles of gray and brown sandstone slabs set on a high cliff overlooking the Apishapa River and the surrounding country. The circles of stones would have had no usefulness as a defense. Nor are they like rings marked off for wigwams. The labor involved in carrying the slabs and aligning them according to a pattern can hardly be justified unless the enclosure had some ceremonial function.

The Colorado circles are not constructed on so grand a scale as the prehistoric Britons achieved at Stonehenge, but the Indians had a most impressive setting for their rites. One group of circles ranges from one pace to nine paces in diameter, and the group is more or less surrounded by a slab fence with an opening at one end. At another site along the Apishapa, Professor Renaud discovered another group of circles made of larger monoliths, and here he found that each circle had an upright stone post in the center. "A solar cult may be suggested by the circular shape and the presence of a central monolith." So far as is known nothing similar to the stone circles has been reported heretofore in the Southwest states.

ITEMS

SEDIMENT from the Mississippi River, deposited around the delta in the Gulf of Mexico, is thought by Dr. William Bowie, of the U. S. Coast and Geodetic Survey, to have been responsible for the small earthquake felt in New Orleans on Sunday, October 19. According to the theory of isostasy, developed largely by Dr. Bowie, the whole earth is in "isostatic" equilibrium. That is, the mountains are of lighter material than the lower regions, and together they all balance. As material shifts, whether by deposit of sediment or by erosion, the equilibrium is restored by movements of the parts of the earth, and sometimes these movements produce earthquakes.

HERDS of wild elk from their haunts in the foothills of the Olympic Mountains have moved down to graze along the highway to Lake Quinault. So many of the large animals cross and recross the road as to frequently halt automobile traffic. Unlike the elk herds in Yellowstone National Park, the Roosevelt elk of the Olympics have abundant winter pasturage unhampered by heavy snows. They have increased until there is a possibility of an open season during the autumn of 1931.

MORE solid carbon dioxide, commonly known as "dry ice" is now used than the liquid form of the gas, in which it was formerly marketed. D. H. Killefer, chemist of the Dry Ice Equipment Corp., New York City, told members of the American Chemical Society at the recent meeting in Cincinnati that nearly thirty thousand tons of this former laboratory curiosity will be used during 1930. This is greater than the total amount of liquid carbon dioxide used in 1927, the latest year for which figures are available. It is used for refrigeration, because of its advantages over ice in being colder and in not melting, but changing directly from the solid form into the gas.

FROM the interior of the earth beneath Jackson County, Colorado, comes snow white, solid carbon dioxide, which freezes at 70 degrees below zero, Fahrenheit. Professor F. F. Hintze, of the University of Utah, reported to the American Institute of Mining and Metallurgical Engineers that enough is obtainable in one day to fill a train. Professor Hintze explains that the carbon dioxide is contained in the earth as a gas under very high pressure, not as the cold solid. But when it comes to the surface, mixed with about 10 per cent. oil, it expands so fast upon being released from confinement and gives up so much heat that it freezes both itself and the oil. In its frozen state engineers would apply this gas to the refrigeration and preservation of food.

THE amount of potash in the soil of the orchard appears to have an important bearing on the storage life of the apples produced. Dr. Franklin Kidd and Dr. C. West, of the Low Temperature Station, Cambridge, have found that the storage life of apples on which they worked increases as the amount of available potash in the soil increases. Trees grown in soils deficient in available potash yield apples which are particularly susceptible to low-temperature breakdown in cold storage. In order to insure a long storage life it therefore seems important that there should be a good supply of available potash in the soil.

PROFESSOR JOHN W. M. BUNKER, of the Massachusetts Institute of Technology, and Robert S. Harris, research associate at the institute, reported to the American Public Health Association, at its recent meeting, a much wider range of ultra-violet rays than that commonly thought effective helps in the prevention or treatment of rickets. Their report was based on a two-year study of 800 animals. The wave-length range generally thought effective is between 3022 and 3026 ångstrom units. An ångstrom unit is about one two hundred and fifty millionth of an inch. When this range is extended to include ultra-violet rays of shorter wave-lengths, greater protection against the disease is obtained.

BLOOD group tests to determine a child's paternity should not be made until at least two weeks after birth, Dr. Carl H. Smith, of Cornell University Medical College, advises in a note to the American Medical Association. Dr. Smith has found from a study of blood groupings that for the first ten days or so the infant's blood group is influenced by the direct transmission before birth of some of the mother's blood. After that period, the child's own blood group becomes fully established and a fair, reliable test can be made.

SCIENCE NEWS

Science Service, Washington, D. C.

DR. LANDSTEINER'S DISCOVERY OF BLOOD GROUPS

DISCOVERY that human blood is of four different types, and that blood of one type does not always mix with blood of another type, has won the 1930 Nobel prize in medicine for Dr. Karl Landsteiner, of the Rockefeller Institute for Medical Research.

The enormous importance of Dr. Landsteiner's discovery has been evident to patients who have had the life-saving operation of blood transfusion performed. For this operation the blood of the donor and that of the patient must mix well, or serious and even fatal results may occur. Consequently before each transfusion, samples of the two bloods are tested or "matched" to see if they are compatible and belong in compatible blood groups.

When the blood liquid of one normal, healthy person and the red blood cells of another are put in the same test-tube, instead of mixing freely the red cells often clump together as if they were glued, Dr. Landsteiner observed during the course of some investigations made in Vienna in 1900. Scientists call this gluing together or clumping, agglutination. When it happens in a man's vein, following blood transfusion, death may result.

Agglutination does not take place at random, but depends on certain definite properties of the blood. It is on the basis of these properties that blood was divided into different groups or types. Three of the types were discovered by Dr. Landsteiner and the fourth by two of his students.

Every human being belongs to one or the other of the blood groups. To a certain extent blood groups are inherited, and this fact is often used to determine paternity. If the blood groups of each parent are known, one can state to which groups their child might belong.

BACTERIOPHAGE THERAPY

CARE in selecting races of bacteriophage, destroyer of disease germs, is essential for its successful use in the treatment of disease, its discoverer, Professor F. d'Herelle, of the Yale University School of Medicine, said at the New York Academy of Medicine on October 27.

Bacteriophage therapy is still in its infancy and many studies are still necessary before we will learn all the results that we may anticipate, but what has already been done in many diseases justifies the belief that this is the specific treatment *par excellence* and that it will attain a wider and wider application.

Bacteriophage is a parasite that is not able to develop except by penetrating into the interior of a living germ or bacterium, secreting a bacterial solvent, and then reproducing itself by feeding on the dissolved germ. Because of its destructive action on germs, it is being used in the treatment of certain diseases, especially dysentery. Very powerful, less active and very weak races of bacteriophage have been isolated.

Any attempt at treatment with any type of bacteriophage of low potency is to court certain defeat. The *sine qua non* of success is the utilization of bacteriophage races selected with care.

Bacteriophage normally appears in the body of the patient at about the time when he shows signs of recovery from the illness. Treatment by bacteriophage is the best specific treatment because it leads to recovery through a mechanism identical with that of natural recovery.

PSITTACOSIS AND THE IMPORTATION OF PARROTS

THE ban on the importation of parrots into the United States, which became effective last January during the psittacosis outbreak, has been lifted, according to an announcement of the U. S. Public Health Service. Parrots may now be brought into the country through ports where federal quarantine officers are stationed, subject to certain regulations of shipping, detention and inspection.

Shipments are limited to 100 birds each. No more than 10 birds may be shipped in a crate of specified size. These must be constructed in a prescribed manner with special provision for ventilation and cleansing. The parrots must be protected from the weather, especially cold, during the voyage and must be kept clean and be properly fed and watered. All parrot shipments will be detained for 15 days so that their health and general condition may be observed by the quarantine inspector.

An individual returning from the tropics or elsewhere abroad may bring in as many as five privately owned parrots without having them held for the 15-day inspection period. However, these birds must have been kept in a good sanitary environment away from contact with other parrots for at least 60 days preceding their entry to this country.

During the 1929–30 outbreak of psittacosis 169 cases with 33 deaths occurred in the United States. The disease appeared almost at the same time in Argentina, Algeria, Germany, Austria, England, Holland, Czechoslovakia, Denmark, Switzerland, France, Spain, Portugal, Canada, Hawaiian Islands and the United States. In most of the cases, the disease was acquired from infected birds, though a few cases of transmission between humans were reported. The organism causing the disease has not yet been definitely established. Development of the disease in the birds apparently is influenced by the adverse conditions under which they were kept during importation. The disease is probably endemic among the birds of the tropics.

The new regulations regarding imports of parrots are expected to prevent further introduction of the disease into this country. However, the warnings, issued during the outbreak, against unnecessary handling or fondling of the birds, particularly against the practice of feeding them directly from mouth to bill, should still be observed.

PHOTOMICROGRAPHS BY ULTRA-VIOLET LIGHT

A NEW method of taking photographs through the microscope, that will show about a fifth again as much as ones taken with ordinary methods, was announced recently by Dr. A. P. H. Trivelli, of the Eastman Kodak Company, and Leon V. Foster, of the Bausch and Lomb Optical Company, according to a report made to the Optical Society of America, in session at the University of Virginia.

The new method involves taking the photomicrographs with ultra-violet light, which in itself is not new, but which has formerly required the use of special lenses of quartz or fluorite and special slides for the preparation of the material to be examined. For the short ultra-violet rays formerly used, glass is opaque, and so ordinary glass lenses and slides could not be employed. Though Dr. Trivelli and his associate use ultra-violet light, they use waves just a little shorter than visible violet light, that is, waves about 1/70,000th of an inch in length. Expressed in units for wave-length, this is 3,650 ångstroms, an ångstrom being a ten millionth of a millimeter, or about a 250 millionth of an inch. Visible light includes the range of wave-length from about 4,000 ångstroms for the shortest violet rays to around 7,000 for the longest red. Ultra-violet light down to even less than 3,650 is transmitted by ordinary glass lenses and slides, though very much shorter waves are absorbed.

The source of the light is a mercury arc lamp, giving the purple light often used in photographic studios. As the ultra-violet light is not visible, and it is necessary to focus the microscope, they make use of a band of green light in the illumination for this purpose. Two filters are used. One transmits only this green color, and is put between the light and the microscope when it is being focussed. Then another filter, that transmits only the ultra-violet component of the light, is substituted and the photograph made. The lenses are constructed so that both the ultra-violet and the green light rays are focussed at the same place.

Dr. Trivelli showed examples of photographs made with the new equipment. One was of hollyhock pollen magnified 300 diameters. With the picture made by ordinary light a gray ring appeared around the grains, but in the ultra-violet pictures this appeared distinctly as a number of sharp spines.

Ultra-violet photography with the microscope has been used to reveal germs invisible with ordinary means, and with it so much simplified by the method of Dr. Trivelli and Mr. Foster, it is likely that more research workers will be able to use it. The reason that it shows greater detail is found in the short wave-length of the ultra-violet light. The microscope will not show details smaller than the length of a single light wave, so by using shorter waves smaller things are revealed. With X-rays far shorter yet, very much more minute objects might be seen, even the molecules of matter themselves. Unfortunately, no one has yet invented a method of focussing X-rays and they can not be used in this way.

STEREOSCOPIC PROJECTION FOR MOTION PICTURES

No successful means of projecting stereoscopic movies, without requiring some sort of mask or goggles before the observer's eyes, has yet been invented, but members of the Optical Society of America, at the University of Virginia, saw for the first time a method of doing it with still pictures. Dr. Herbert E. Ives, of the Bell Telephone Laboratories, under whose direction their work in television has been carried out, demonstrated the method, which is his invention.

Even with still picture projection the apparatus used is very crude and projected small pictures are visible to only a few at a time. However, the methods used are capable of refinement. But Dr. Ives held out no hope of true stereoscopic movies by such means in the near future.

"These methods are theoretically applicable to the projection of motion pictures in relief," he said. "The complexity and cost of apparatus for satisfactory motion picture projection would, however, be very great."

Dr. Ives's method traces its ancestry to an invention of his father, Frederic E. Ives, inventor of the half-tone process used to reproduce photographs in newspapers and magazines. This was called the parallax stereogram. As with ordinary stereo pictures, intended to be viewed in the double-lens stereoscope, two pictures were made from two viewpoints, separated approximately the distance between the two eyes. These were both printed on a glass transparency consisting of fine vertical strips, so that every alternate strip presented the view seen from one point and the intermediate ones the other. A grating consisting of opaque and clear strips the same width was carefully adjusted and fixed just in front of the picture. Then, when looked at from the correct position, this grating covered one set of strips for the right eye and the other for the left, so the picture stood out in full relief.

Dr. Ives a few years ago elaborated this and made what he called the parallax panoramogram, a device which was invented independently by Dr. C. W. Kanolt, formerly of the Bureau of Standards. This was taken with a special form of moving camera. The result was a picture made up of strips, but each strip consisted of a minute panorama of that part of the subject, from a number of viewpoints. This was viewed through a grating, in which the clear strips were much narrower than the opaque ones, so that when viewing the picture from any direction the eyes saw the parts photographed from a similar direction. When looked at with two eyes, each saw the proper part and stereoscopic relief was obtained. The advantage of this was that the picture did not need to be viewed from a certain angle.

Dr. Ives has now developed this further. In one method he replaces the grating with a film on which are embossed narrow vertical ribs, like those used for amateur color motion picture film. The ribs act as cylindrical lenses, directing the light the same way as the clear strips in the grating, but are not as wasteful of

light. Another improvement is obtained with this film to produce a stereoscopic picture that does not need to be viewed with the light behind, but can be handled like an ordinary photograph.

For projection, Dr. Ives has worked out two methods, both of which he demonstrated. In one, the screen is made up of a series of vertical glass rods, each designed so that the light is reflected back in the same way that it came. A battery of many lanterns all project on this screen, each projecting a view of the original subject made from a particular angle. Each picture can be seen from only one direction, so each eye sees its proper picture, but for satisfactory results an enormous number of separate projectors would be needed.

The other method is to use a screen of rods, so shaped that when viewed, one sees only light from a very narrow strip on the back. By means of a very accurate lens, a parallax panoramogram, as used for the smaller pictures, is projected on the back of this screen, and the strips of the pictures registered with those of the screen with great precision. Then, when viewed from the front, the audience sees a stereoscopic picture. Neither method is practicable for motion pictures under present conditions, because of the large number of separate films and projectors that would be required for the first and the extraordinarily great accuracy needed in the projection of the second.

ITEMS

EXCELLENTLY preserved fossils of sea-going whales which visited the Michigan peninsula during the ice age have been discovered in two localities, according to an announcement made by Professor Russell C. Hussey, of the department of geology of the University of Michigan. Some twenty to thirty thousand years ago the whales swam inland by way of the St. Lawrence or the Hudson waterway, through the prehistoric glacial lakes and into shallow rivers at the edge of the retreating ice sheet which then covered northern North America. The whales caught in the rivers could not turn around and find their way out, and Professor Hussey believes they must have died of starvation. Their bones were cast upon the beaches of those times and are found to-day in gravels. As found at both localities, one ten miles south of Ann Arbor and the other in Oscoda County in the northern part of Michigan, the bones are bleached white with backbone and ribs perfectly preserved. The University of Michigan hopes to acquire one skeleton for exhibition purposes.

IN the higher reaches of the Rocky Mountains in the northern portion of Montana lives a species of mosquito that hibernates during the winter as adults, under logs and in sheltered spots, and may be seen flying on the first warm day of spring. These mosquitoes are large, with spotted wings, and often are referred to as snow mosquitoes. According to Drs. N. Kadletz and L. Kusmina, of Russia, these mosquitoes store up fat in the summer, as do bears, and subsist on it while dozing through the winter.

A CLUE to life during the Triassic Period has been yielded by fifteen tons of earth from the banks of the Little Colorado River, east of the Grand Canyon in Arizona. Barnum Brown, of the American Museum of Natural History, and L. I. Price, of Oklahoma University, sifted this material through fly screens to recover the remains of the probable reptile ancestor of the dinosaurs and the phytosaurs. The siftings from the fossil earth were hauled ten miles to a spring before the fragments could be washed and looked over. This process required three weeks of patient work and rewarded the investigators with only enough fragments to cover the bottom of a cigar box a half inch deep. But these fragments were enough to enable the scientists to restore the rare little beast that lived before the dinosaur and is believed to be ancestor to it and to another ancient reptile, the alligator-like phytosaur. The small ancestral reptile is about three feet in length.

A STUDY just reported by the Milbank Fund has shown that the young industrial worker is more apt to get sick than the older employees. On the whole, workers in industry are healthier than the general population. The statistical analysis of the study was made for the fund by Dean K. Brundage, of the U. S. Public Health Service. The fact that the older employees are healthier than the younger ones and likewise healthier than men and women of the same age groups outside of industry can probably be explained on the grounds that the healthier individuals tend to remain in industry to a greater extent. Industrial workers appear, in the main, to be the flower of the general population in physique and constitution. Women workers tend to be absent because of illness from 50 to 100 per cent. more often than men, especially for short periods. Married women were absent much more than single women.

MILWAUKEE, Wisconsin; Syracuse, New York; East Orange, New Jersey; White Plains, New York, and Sidney, Ohio, were the winners in the first Inter-Chamber Health Conservation Contest sponsored by the U. S. Chamber of Commerce, it was announced at the recent meeting of the American Public Health Association. The health departments of the five cities were awarded certificates. The object of the contest: "To assist in reducing economic losses in the United States due to unnecessary illness and death. It is hoped to do this through the organization of health committees of local chambers of commerce or similar associations which assume leadership in cooperating with the official and voluntary health agencies of the community." The contest for 1929 was so successful that a similar one has been started for 1930, and 183 cities have already enrolled. The only requirement for enrolment is that the local chamber must be affiliated with the Chamber of Commerce of the United States. As in the previous contest, the services of technical experts of the American Public Health Association will be available, without charge, to assist health departments of contesting cities in mapping out a program or in any other way.

SCIENCE NEWS

Science Service, Washington, D. C.

COAL MINE EXPLOSIONS

Coal mine explosions like the one which claimed seventy-nine lives at Millfield, Ohio, are preventable disasters, because they probably need never occur if every mine were to make use of the precautionary measures, especially rock dusting, already worked out by mining engineers, is the belief of Mr. George S. Rice, chairman of the Mine Safety Board, of the U. S. Bureau of Mines.

Coal when in the form of dust suspended in air is explosive; and in coal mines, as in blasting powder plants, every precaution is necessary in order to prevent explosions and fire. At this time of the year when the mines are working to capacity, and coal dust becomes dry from the entering cool dry air, operators should be particularly vigilant and cautious.

Government recommendations and state regulations have placed in the hands of mine operators information regarding the most effective methods of guarding against disasters. All open lights or other sources of ignition, whether from lamps, open sparking machinery or flaming explosives should be avoided.

Another approach to the problem, besides the elimination of sources of ignition, is the thorough ventilation of the mine and the treating of the explosive coal dust by what is known to mining engineers as "rock dusting."

Rock dusting is a recently adopted method of making the coal dust non-explosive. Finely pulverized inert material is spread in the mine and mixed with the coal dust so as to dilute it. If more than 65 per cent. of the mine dust is incombustible, the mixture can not explode in a dust cloud. Every portion of the mine must be thoroughly and constantly rock dusted for complete safety. Just as one match in a powder magazine brings disaster, so one explosive area in a mine may cause the loss of miners and mine.

The safety division of the U. S. Bureau of Mines has found that notwithstanding the fact that mining engineers generally recognize the fact that wide-spread explosions can be almost absolutely prevented in coal mines by this method, rock dusting is not yet used in the majority of our coal mines. Despite the fact that thorough rock dusting would cost less than one cent per ton of coal, only a small percentage of the mines in this country are thoroughly rock dusted. In Ohio, of the approximately 600 mines operating, according to latest reports only about 5 are rock dusted. A larger number are partially rock dusted and this lessens the hazard to a degree. The Millfield mine was not even partially rock dusted.

It is estimated that the cost of equipping mines with the most modern and best safety measures, and of maintaining them in working condition would add less than 10 cents per ton to the cost of coal. Yet a major explosion may cost as much as a million dollars.

WASTE NATURAL GAS

The billions of cubic feet of natural gas wasted to the atmosphere in the production of oil can be pumped back into the wells from which it came in order to force to the surface oil that would otherwise be lost.

Not only will gas returned to the wells increase production, but if little gas is allowed to escape from a producing well more oil will be obtained. This fact was brought out in a paper on improvements in production practice presented by W. W. Scott, of the Humble Oil and Refining Co. of Houston, Texas, before the annual meeting of the American Petroleum Institute.

"In any oil pool that depends upon gas movement for production, and one in which it is possible for a single operator or a group of operators to develop the pool as a unit," Mr. Scott said, "the cost of conserving gas and returning it to the reservoir will be amply repaid by reduction of lifting cost and increased production from the pool."

As an example of the important rôle played by natural gas in the production of oil, Mr. Scott mentioned the Sugarland field located in the Texas Gulf Coast area about 25 miles southwest of Houston, which, he said, holds a unique position among present-day fields.

"In this field," he continued, "it has been possible to produce oil in such a way as to allow the average pressure on the reservoir to fall off as slowly as possible with a given amount of production. . . . All the gas produced with the oil is collected and about 85 per cent. or more has been compressed and returned to the reservoir. The injection pressure is approximately 1,400 pounds." Greater ultimate production and lower pumping cost were said to be the advantages of this procedure.

THE EARTHQUAKE OF OCTOBER 19

After nearly three weeks of work, collecting reports from people who felt it, Captain N. H. Heck, of the U. S. Coast and Geodetic Survey, has located the position of the earthquake near New Orleans on Sunday, October 19. Captain Heck, who is chief of the survey's division of terrestrial magnetism and seismology, said that the determination of the center of this quake was delayed because of the lack of reports at the time from seismograph stations. The center was about 65 miles to the west of New Orleans, not in the gulf, as was supposed at first.

This quake was located by the old method of isoseismals, that is, lines of equal force of the earthquake. By collecting information from a large number of people who felt the shaking, it is possible to form a good idea of its intensity at various locations. These can be plotted on a map, like the isobars, or lines of equal air pressure, on a weather map. The intensity of the quake weakens as one gets away from the center, so the isoseismals are roughly circular. Their center then marks the center of the quake.

To collect and plot these data take considerable time, but if the quake is recorded by a few seismograph instruments at scattered points, the location of the center can be made with much greater speed. The Louisiana

quake, however, was not a very violent one, and so was not detected on many instruments.

For large quakes, the survey, working in cooperation with the Jesuit Seismological Association and *Science Service,* is able to locate their centers within a few hours, often before any news filters through from the shaken region. Scientists at a number of seismograph stations as soon as they get a record of a quake, telegraph it to Washington in a special code. From one station's record it is possible to locate the quake on a circle a certain distance from it. With several stations, a number of such circles can be drawn and their intersection marks the center of the earthquake. With a large number of stations, individual errors can be detected, and the center located with great accuracy.

A few years ago, using this method, the survey located the center of a quake in a remote province of China, about twelve hours after it happened, but not for several months later did a survivor of the earthquake, which cost thousands of lives, reach civilization with the news.

CAUSE OF THE COMMON COLD

NINETEEN college girls are the latest heroines in the attack of medical science on the common cold. Through their temporary suffering from the colds with which they were experimentally infected by Drs. Perrin H. Long and James A. Doull, of the Johns Hopkins University Medical School, these volunteers aided in the discovery of the important fact that the infecting agent of the common cold is a filterable virus, so minute that it passes through the finest of filters and so difficult to grow that it can not be cultured by ordinary methods. These are important steps toward the conquest of this disease that is particularly prevalent in the fall and winter, but much more research will be necessary before a prophylactic can be offered the suffering public.

The college-girl subjects of the experiments are known in the reports only by their initials, as is customary in medical reports. One of them volunteered to be the subject of experiment twice, the others were the subjects of only one experiment each. The results extend and confirm the views of earlier investigators who showed that the common cold is an infectious disease transmitted from one person to another by something present in the nasal secretions of people ill with colds. But the search for the organism has been narrowed down to one that is in the same class so far as size is concerned, as the causative agents of smallpox, hoof-and-mouth disease and even of more dreaded diseases.

They proved that the filterable virus of cold is present in liquid that had passed through the finest of filters, the Berkefeld W porcelain filter and the Seitz filter of asbestos. These strain out organisms that are passed by filters that heretofore have been considered extremely fine, and the filtrate is actually sterile from the standpoint of ordinary bacteriological technique. Yet this filtrate passed on the colds to the college-girl subjects.

As it has been impossible to cultivate the cold virus in the way that ordinary germs are grown, the next step planned in the attack on the cold is to attempt artificial culture growth of the virus. By introducing the submicroscopic cold germs to the presence of living cells kept alive in test-tubes, it is hoped that the cold virus may be grown artificially. That may give an opportunity to try to develop a protective vaccine.

Because colds are prevalent in the fall and winter and infrequent in the summer, the experimental work is done in the summer to minimize the chance of human test subjects picking up colds accidentally. The researches just reported in the *Proceedings* of the Society for Experimental Biology and Medicine were made last summer and now continuing research is being planned for next summer.

The John J. Abel Fund for Research on the Common Cold, supported by the Chemical Foundation, conducted the researches. Dr. Long will continue the work next year while Dr. Doull this fall joined the faculty of the Western Reserve University.

GUAYULE RUBBER

THE guayule plant, source of America's new home-grown rubber, will not stand too much coddling. Certain luxuries of cultivation, principally ample irrigation, cause it to lie down on the job.

Dr. David Spence, technical director in charge of guayule culture near Salinas, Calif., described to the American Chemical Society, at Los Angeles, Calif., his recent experiences in making desert bushes grow rubber. The first really substantial California crop, due this winter, promises to give the rubber industry something to think about.

Guayule, an unimposing, scrubby bush of the sunflower family, seems to have been cast out by nature to fight for a living with cacti, creosote bushes and the like in the arid desert wilds of Mexico. Peons earn a scant living by uprooting the plant, transporting it by donkey to the coast and selling it to rubber producers.

American rubber interests have long been fearful of an emergency involving embargo on tropical rubber. Under the leadership of Dr. Spence, they have chosen California as the most likely state in which to develop the domestic product.

If the guayule plant is forced to endure a drouth of several months, it will produce a multitude of fine droplets of rubber all through its larger stems and roots, particularly near the cambium or new-wood layers. As high as 18 per cent. of the total weight of the bush is actual rubber in the new high-bred strains of the plant being propagated at Salinas. If, however, the plant be given a continuous supply of moisture in the manner common to ordinary agricultural crops, it just forgets to grow rubber. Life is apparently too soft. The plant simply vegetates and makes an immense amount of worthless brush. The central valleys of California afford a climate suited to this situation. No rains of any significance occur between May and October, and comparatively little in April and November.

California guayule rubber was subjected to recent tests in auto tire formulas in a local plant. Results indicate

that it is nearly equal to Hevea or tropical rubber in tensile strength, elasticity, etc. Chemically it seems to be identical with the ordinary caoutchouc of commerce. The Salinas experiments promise acreage yields close to those of the tropics. Closer plantings may run the yields even higher than those of Hevea.

THE STUDY OF LEPROSY

THE same group that is studying the tuberculosis bacillus has been asked by the Leonard Wood Memorial to undertake the study of leprosy. The research will be directed by the Medical Research Committee of the National Tuberculosis Association, of which Dr. William Charles White, of the U. S. National Institute of Health, is the chairman.

As in the recent attack on tuberculosis, hundreds of thousands of leprosy bacilli will be grown in the laboratories of the H. K. Mulford Co. These will be taken to the Sterling Chemical Laboratory of Yale University where they will be analyzed under the direction of Professor Treat B. Johnson. At the same time the clinical studies with leprosy patients will be carried on at the government institutions for the care of lepers and in those of the Leonard Wood Memorial. The germs causing the two diseases are members of the same family. They even grow in the same cells of the human body, the monocytes. The germs of tuberculosis, however, invade mainly certain parts of the body, such as the lungs, while the leprosy bacilli occur chiefly in the skin.

Some 15 or 20 strains of lepra bacilli have been cultivated from human cases, but until recently it has never been possible to produce leprosy in any animal by transferring any of these germs to the animal's body. This has now been accomplished by Professor K. Shiga, of the Imperial Medical Faculty at Seoul, Korea. He claims to be able to produce leprosy in rats by injecting the lepra bacilli into rats whose powers of resistance were weakened by having lived on a diet lacking in vitamins.

ITEMS

A FIVE-YEAR search for definite evidence of the first American immigrants, who are thought by anthropologists to have come to this continent in prehistoric times from Asia, was recently described in a report to the American Philosophical Society by Dr. Aleš Hrdlička, curator of the division of physical anthropology of the U. S. National Museum. Under Dr. Hrdlička's direction, the museum has been carrying on intensive anthropological and archeological work in Alaska since 1926. The remaining full-blood Alaskan people, both Eskimo and the rapidly vanishing Indian, have been studied, and old sites have been examined for traces of their prehistoric predecessors. In these latter investigations there was discovered a wholly unexpected rich and highly artistic Eskimo culture, represented mainly in implements of walrus ivory which have since become fossilized. This culture antedates the well-known recent Eskimo culture.

"LUBRICATED mountains," which have moved considerable distances and formed a landslide topography of unsurpassed grandeur and magnitude, have been found in the John Day River area of interior Oregon, by Dr. Edwin T. Hodge, of the University of Oregon. In the vicinity of Maupin butte, overlooking the John Day chasm, "great masses measured in square miles" have moved toward the river, producing landslide pockets and lakes. The topography is due to the fact that the Columbia River lavas, hundreds of feet thick in places, poured over the John Day River clays, a formation which is easily unconsolidated and softened by ground water. The clays form a lubricant on steep slopes over which the heavy, greatly jointed Columbia basalt slides. Frequently, huge masses of the overlying lava have broken loose and slipped down the valley walls. Although the "greased" basalt found in the John Day basin of central Oregon moved from its original position before the coming of white man, Dr. Hodge sees no reason why similar slides should not occur in the present age, providing the underlying clays receive sufficient ground water.

STUDIES showing that the virus thought to cause infantile paralysis is remarkably stable and resists treatment that would destroy a number of dangerous disease germs, have been reported by Miss B. F. Howitt, working under Dr. Karl F. Meyer, of the Hooper Foundation for Medical Research of the University of California. The virus is able to resist treatment with chemicals which kill streptococci, staphylococci and colon bacilli. After being precipitated, whirled around in centrifuges at high speed, washed, filtered, mixed with acetic acid, heated to 136 degrees Fahrenheit, placed on ice and otherwise subjected to chemical purification, the fluid thought to contain the virus and also the material taken out of it in the process were capable of causing infection in some instances. By repeated centrifuging and precipitation with lead acetate, the fluid can be rendered as clear as distilled water, and yet it is still capable of destroying the function of certain parts of the nervous system or of dealing death.

SWEDISH chemists are at present engaged in research for the recovery of by-products from the manufacture of wood pulp. According to a recent announcement, two Swedish chemists attached to the Swedish College of Pharmacology have obtained a patent on a method for the extraction of phytosterin from sulphate soap (pine oil). It is claimed that this substance will prove a substitute for lanoline and rape oil as the base of salves and marine oil. It is further stated that at least 18,000 tons of pine oil can now be recovered from the manufacture of sulphate pulp in Sweden, whereas the actual production is only about 5,000 tons. If sulphate soap corresponding to a quantity of 18,000 tons of pine oil is treated for production of phytosterin it would yield about 450 tons of this product, which, if used for marine oil, would yield no less than 90,000 tons of oil. Although the practical utility of the method has not yet been tested on a large scale the inventors think that it will prove a valuable means to reduce the cost of the pulp-making and thus make the operations far more profitable.

SCIENCE NEWS

Science Service, Washington, D. C.

THE NOBEL PRIZE IN PHYSICS

THE discovery that light of a single color, or wave-length, shining on certain transparent substances, is partly changed to other colors is regarded as the greatest accomplishment so far of Sir Chandrasekhar Venkataram Raman, of the University of Calcutta, who has been awarded the Nobel Prize in physics. Named after its discoverer, this phenomenon is now known as the Raman effect, and it was first announced in the spring of 1928. Research laboratories in all parts of the world are now engaged in studying it, because it has opened up an entirely new field in the study of molecular structure.

One of the first investigators, outside of Sir Chandrasekhar's own laboratory, to verify the discovery, was Dr. R. W. Wood, of the Johns Hopkins University. Working at the private laboratory of Alfred L. Loomis, Tuxedo Park, New York, Professor Wood considerably improved the original apparatus and detected the effect in the summer of 1928.

The Raman effect occurs when monochromatic light (which is light of a single color, or wave-length) shines on transparent substances, such as quartz, chloroform or water. Generally a mercury arc is used as the light source. The light that is scattered by the transparent material is mostly of the same color as that of the light illuminating it. The spectroscope, the instrument that analyzes light, however, shows that part of this light is changed to wave-lengths a little longer or shorter than that of the source. That is, part of the light is either more reddish or more bluish.

On the spectrum photographs the result is a heavy line, representing the main color, attended on either side by narrower and fainter lines. The fainter lines on one side are arranged the same way as those on the other, except that they are reversed, as if reflected in a mirror, the center heavy line being the mirror. Sir Chandrasekhar, in his first experiments, found only a single and very faint line on the high frequency, or blue, side of the main one, but with improved apparatus Professor Wood found groups of nearly equal strength on each side.

The great importance of the discovery came from the fact that the differences between the frequency of the exciting color, used to illuminate the substance, and the frequency of the additional, or Raman, lines, is precisely the same as the frequencies of the infra-red absorption bands of the same substance. These absorption bands, that is, the bands of color absorbed by the substance with infra-red light, or light vibrating too slowly to be seen, are very difficult to determine directly, so the Raman effect was a convenient means of studying them, thus giving a new means of studying the properties of the molecules of these substances, and of the structure of light.

Incidentally, the Raman effect was a rather convincing proof of the validity of the quantum theory of light, which supposes that light and other radiation consist of separate pulses, or quanta, rather than waves. Five years before the effect was discovered, it had been predicted, on the basis of this theory, so when it was detected it immediately provided good evidence in favor of the existence of light quanta.

Sir Chandrasekhar was born in India on November 7, 1888, and graduated from the Presidency College in Madras in 1904. In 1907 he joined the Indian Finance Department, and after that held various scientific positions, finally becoming Sir Taraknath Palit professor of physics at the University of Calcutta and honorary professor at Benares Hindu University. In 1924 he visited the United States, following the meeting of the British Association for the Advancement of Science at Toronto, to attend the centenary celebration of the Franklin Institute in Philadelphia. After that he served for a time as research associate at the California Institute of Technology at Pasadena. In the same year he was made a fellow of the Royal Society, the highest British scientific body. He was knighted in 1929.

THE NOBEL PRIZE IN CHEMISTRY

THE award of the 1930 Nobel Prize in chemistry to Professor Hans Fischer, of Munich, for his research on human blood is a recognition of the value of what is sometimes called pure science, meaning discoveries or developments which are of great theoretical importance but which may or may not have practical value.

Professor Fischer's recent noteworthy contribution was the synthesis, or laboratory production, of hemin, which is one of the components of hemoglobin, the red coloring matter of the blood.

Hemin has also been called the respiration ferment, said to rule the organic world. In the higher animals, hemoglobin is a transport agency for oxygen, carrying it from one place to another in the body, but the respiration ferment, hemin, takes up the atmospheric oxygen, which was transported by the hemoglobin, and transfers it to certain organic substances which in turn become oxidized. The respiration ferment or enzyme rules the organic world because in everything that happens in living matter, respiration furnishes the driving force. It is found in all living cells.

Professor Fischer's synthesis of hemin made possible the artificial production of hemoglobin itself, which is indispensable for the life of animals, especially mammals.

When Professor Fischer announced this synthesis last year, scientists hailed it as an important contribution to the chemistry of living matter. Some claims were made for it on practical grounds, but Professor Fischer himself did not agree with these views.

"Contrary to many fantastical statements of the daily press no changes will take place in the field of therapeutics [treatment]," he said, "since hemin has been easily obtainable from blood for a long time. It is improbable that the intermediate products of the syn-

theses and the numerous isomeric hemins, on which work is being done, will gain a practical importance but their investigation is of interest from a theoretical viewpoint. In addition, the influencing of the metabolism of the blood pigment in this way is not likely since this probably depends upon sterins or substances closely related to them.''

Professor Fischer was born at Hoechst-am-Main in 1881. He studied at the University of Lausanne, at Marburg, where he received the degree of doctor of philosophy, and at Munich, where he was made a doctor of medicine. He has been on the faculties of various German universities and is now head of the Organic Chemical Institute of the Munich Technical High School. He has devoted himself to studying the pigments of blood and bile, and pyrrol chemistry.

EARLY MAN IN NEVADA

WITH high hopes of uncovering further data bearing on the last phases of the Pleistocene or ice age period in America, and especially on the association of man with animals now extinct, the joint expedition of the Southwest Museum of Los Angeles and the California Institute of Technology has resumed its exploration of Gypsum Cave near Las Vegas, Nevada. The work is in charge of Curator M. R. Harrington, of the Southwest Museum.

This is the cave which yielded, last spring, numerous bones of the ground-sloth, Nothrotherium, together with enormous claws with horny covering still intact and even masses of the coarse tawny hair of the same animal; also bones of two species of American camels and at least one type of native horse. All these are well-known Pleistocene or ice age species except the smaller of the two camels, which seems to be new. This was a tiny variety related to the South American llama, with slender limbs like those of a gazelle.

Even more important was the finding, in every room of the cave, of evidence indicating the association of man with these extinct animals, in the form of charcoal, burnt sticks, flint dart-points and crude wooden dart-shafts decorated with painted designs. These objects were found in the same deposits as the bones of the extinct animals, in some cases at lower levels, and in one instance a patch of charcoal, probably the remains of a campfire, was found beneath two layers of ground-sloth dung about eight feet below the present surface. Near the surface and far above the campfire were implements left by the Paiutes, the Pueblos and the Basketmakers, these last the earliest people hitherto known to have inhabited the southwest.

The finds were considered so important that the Carnegie Institution of Washington made a grant of money to the Southwest Museum to supplement the limited funds of the latter institution in carrying out the work. It is hoped that during the present season evidence will be found bearing on the question now puzzling the archeologists and paleontologists—whether man really existed in America twenty or thirty thousand years ago, the time usually assumed for the Pleistocene, or whether some of the Pleistocene animals lived on until more recent times, say, up to within ten or fifteen thousand years. It is also hoped to find human bones in the older deposits, from which it may be determined whether these early Americans were of the primitive type associated in Europe with the low-browed Neanderthal cave man who flourished in the Pleistocene period.

RADIO AS AN AID TO AVIATION

AVIATORS can not only fly from city to city without ever seeing the ground, but now it is possible for them to make a perfect landing on a field completely enveloped in the densest fog, that not even the most powerful light beacon can penetrate. That is, they can do so if their plane and the field are equipped with the newest radio apparatus developed by the Bureau of Standards. By experiments made at the College Park airport, near Washington, H. Diamond and F. W. Dunmore, two of the bureau's radio engineers, have developed the new system.

Two radio sets are used. One is the same set used for receiving the powerful radio beacon signal in flying between cities. This is also used for the reception of spoken orders and other signals received with head phones. For landing at the proper angle, an ultra-short wave receiver is used, as the signals for this are of about 3½ meters wave-length, or 93,700 kilocycles.

The system developed several years ago for guiding the plane over the route makes use of two beam antennae. Each sends out a signal mainly in a certain direction. The two are oriented at right angles to each other, one to one side and the second to the other side of the route. As the plane flies half way between the two beams, the two signals are received with equal intensity, but if the pilot wanders to one side or the other, one signal becomes more powerful. The bureau has developed two types of indicators for this arrangement. In one, a pointer on a dial remains at zero when both signals are equal, and moves to the proper side when one becomes more intense. In the other type, there are two vibrating reeds, the ends of which appear as two white bands on the instrument board. When both are the same length, the pilot knows that he is flying the proper course, but if one becomes longer, it indicates that the ship is off in that direction. An arrangement exactly the same, but using lower power and smaller loop antennae in the transmitter, is used to give the pilot the direction of the runway on which he is to land. But in addition to the direction, he wants to know just when he is over the edge of the field, and when he is gliding at the proper angle.

To tell the boundary of the field, another type of transmitter is used, in which the signal, heard in the head phones, is loud as the pilot approaches the field, but disappears completely as the pilot is directly over the antenna, which is placed at the edge of the field.

To tell the proper angle at which to glide, the engineers have developed a very ingenious arrangement

making use of signals at a very high frequency, or short wave-length. These can be directed very accurately in a narrow beam. However, the pilot should not bring his plane down along a straight line, but along a curve, first dropping rapidly, then flattening out as he approaches the ground. Along the center of the radio beam is the line of the greatest signal strength, but a short distance away it drops considerably. However, the nearer the transmitter, the louder is the signal. Therefore, if the pilot hits the beam head on near the center, then starts to drop, and, as he does so, approaches closer to the field, the signal will remain of the same strength, because the approach to the transmitter compensates for the greater distance from the center of the beam. The curve along which the signal maintains a constant strength is just about the same as the best landing curve. A meter on the instrument board indicates the signal strength, and is adjusted so that the pointer is at the center when the pilot follows the proper landing curve. It indicates either "too high" or "too low" if he departs from the right direction.

MODERN DAIRY METHODS

THE dairy farm has joined the industrial revolution and now cows are bathed, relieved of their milk and sent back to their barns by automatic machinery that resembles the constantly moving assembly line of a large automobile factory.

A rotary combine milker or "rotolactor" just put in commercial use for certified milk production at the Walker-Gordon Laboratories farm or "milk factory" near Plainsboro, New Jersey, milks fifty cows simultaneously with less cost, greater speed and less danger of contamination of milk than the old method of individual milking practiced for centuries.

Upon a sixty-foot circular platform there are fifty milking stalls. Each cow in turn steps upon the moving platform into a stall, where she is held in place by an automatically closed stanchion. As the platform slowly rotates, the cow receives an automatic warm water shower bath while above her the milking machine and milk jar of her stall is being cleaned and sterilized by machinery. Next the cow receives the attention of the attendant whose sole duty consists of drying the udders with individual sterilized towels. Next the cow is inspected by an expert hand milker who merely starts the milking process, which is accomplished by milking machines. Just 12½ minutes after the cow steps on the milking merry-go-round the milking is complete, the cow is automatically released to walk back to her barn for a dinner of special dehydrated alfalfa and other feeds to give a balanced ration. The jar containing her milk automatically empties into a weighing and recording device and flows through pipe lines leading to the bottling plant.

Under this new system the cow goes to the milking machines instead of the milker visiting the cow. Even this walk that the cow must take single file through the runways leading to and from the special rotolactor building contributes to her health. For these walks for her milkings three times daily gives her just the amount of exercise she needs.

Under this new system the cow barns become living and dining quarters exclusively and milking is done under the most hygienic conditions in the tiled rotolactor room which is fed with conditioned air.

In an eight-hour day of continuous operation the rotolactor when put into full-time operation will milk some 1,800 cows three times daily. At present there is only one rotolactor in existence, designed and perfected by the staff of the Walker-Gordon Laboratories farm under the direction of Henry W. Jeffers, president. Studies of feed production, both scientific and economic, and nutritional studies of the milk are among the extensive research projects under the direction of Dr. H. E. Van Norman, of the Borden Research Foundation, of which the Walker-Gordon Laboratories are a part. These other studies supplement the development of automatic dairying machinery like the rotolactor.

ITEMS

EVEN the plodding of plough horses will be speeded up to keep pace with our fast moving era, if British horse breeders succeed in the task to which they are now setting themselves. A team that can plough a 300-yards-long furrow nine inches wide can plough nearly two acres more during a month's work than can a team that ploughs only a 280-yards furrow in the same time. On a large arable farm this might amount to a saving of about $725 a year and might mean the margin between profit and loss under the new economic conditions. By mating active, free-moving mares and stallions that can sire progeny not merely able to move heavy loads but also able to move at a more rapid pace than is usual at present, the breeders hope to develop a plough horse capable of surviving competition of the machine age.

THE national health is a dollars and cents asset to the country, Dr. Louis I. Dublin, statistician of the Metropolitan Life Insurance Co., recently told members of the American Public Health Association at their annual meeting. Absence of disease in a city not only makes it a more desirable place to live in but also brings added citizens and increased industry to it. The expenditure of $2.50 per capita or a total of about $300,000,000 every year would be enough to bring the best public health practices to the people of the United States. At present, however, we are spending each year less than $1 per capita for public health. "We as a nation are notorious for our large outlays of every character," Dr. Dublin said. "Our annual candy bill has been estimated as high as $690,000,000; perfumes and cosmetics consume another half a billion and our tobacco bill is rapidly approaching the two-billion mark, if it has not already passed that point. In a country as rich as ours, there should be no great difficulty in making available in a relatively short period of years the small sum which, if put into the hands of our health authorities, will give them the power to reduce sickness and prevent death consistent with our present knowledge."

SCIENCE NEWS

Science Service, Washington, D. C.

THE EARTH'S CENTER

WHAT'S at the earth's center? Though it sounds like an unsolvable riddle, perfection of modern scientific methods and instruments have wrested from the world that its core is formed of metallic iron with a little nickel. This conclusion, generally accepted among scientists, dashes speculation which has persisted to recent years that the earth, because it is heaviest at the center, has a heart of gold.

While not troubling to contradict this Jules Verne conception of fabulous wealth unattainably hidden in the middle of the globe, Dr. L. H. Adams, of the Geophysical Laboratory of the Carnegie Institution of Washington, tacitly refutes any golden dreams of the earth's interior in a report to the Engineering Foundation.

This earth is made up almost entirely of four elements, iron, magnesium, silicon and oxygen, Dr. Adams says. And the remaining 88 elements (including gold, silver and platinum) are confined to the thin film called the crust.

Directly beneath the relatively thin layer of sedimentary rocks at the surface, there is a first layer of granite 10 miles thick; below that a 20-mile layer of basaltic rock. Two thousand miles of peridotite rock (consisting of iron magnesium silicate) come next, while the central core of 4,000 miles' diameter is formed of metallic iron with a little nickle.

Earthquake waves yielded the important key to the secret of the earth's composition. Earthquakes of any considerable magnitude produce elastic waves, some of which travel along the surface of the earth and others pass through it. By measuring the acceleration and retardation of these waves on passing through the earth at various depths, it is possible to judge what sort of rocks and minerals interevene. According to its elasticity, each different kind of rock has a different effect on the speed of the waves passing through it, and so it is possible to judge the kinds of strata traversed.

THE EFFECT OF SMOKE ON TEMPERATURE

SURPRISINGLY great differences in temperatures between a smoke-covered city and near-by country have been found by Fred L. Disterdick, of the U. S. Weather Bureau. He has just reported his researches to the bureau's headquarters in Washington. Comparing minimum temperatures in the city at his office, and in the country, only five miles away, he found that on one occasion when the temperature in the country was 35 degrees it was 52 degrees in the city. When conditions in the country were favorable for the radiation of heat from the ground and the city was covered with its usual blanket of smoke, the city was always at least 5 degrees and most of the time 10 or more degrees warmer.

Mr. Disterdick says that at his station they observed some time ago that the minimum temperatures tended to be lower on Sunday and Monday mornings than on any other days of the week, and that in predicting the lowest temperatures to be expected each night, this has been taken into consideration. It is attributed to the fact that most of the industries, which pour smoke into the air, are closed over the week-end, and the air is relatively smoke-free on Sunday and Monday mornings. He points out numerous effects of the warming influence of the smoke.

Directly west of Des Moines is a large open area more than half a mile wide. In this area the effects of frost are observed early and there is never any smoke to ward off an injury when the temperature is at a critical point. Rather early during September, 1929, a frost occurred that killed practically everything in the unprotected area. In advancing eastward, the extreme edge of the city showed only traces of frost and as the city was penetrated even the most tender vegetation was not injured in the least and continued to thrive for more than a month after areas immediately adjoining were entirely without vitality.

Calling attention to the fact that smoke pots are frequently used, especially in the western states, to prevent frost damage in orchards, Mr. Disterdick declares that the smoke factor should be considered and that the uncorrected data from smoke-infested cities should not be taken as indicative of the climatological conditions.

EXPERIMENTS ON MUSSELS

THE raising of fresh-water mussels in the artificial environment of a laboratory will be one of the projects given attention at the University of Missouri, at Columbia, Mo., in new laboratory space just provided by the university for the use of the U. S. Bureau of Fisheries.

Dr. Max M. Ellis, director of interior fisheries investigations of the Bureau of Fisheries and also professor of physiology at the university, has found a method of speeding up the development of mussels. In its natural environment, the mussel spends the first four to six weeks of his life as a parasite on a fish. Dr. Ellis has discovered a nutrient medium which will take the place for the mussel of the fish. After the mussels have spent an allotted time in this medium, they may be planted in the rivers, relieving a shortage which has been produced by river pollution. Fresh-water mussels are of considerable economic importance because of their value for pearl button making.

The effect of river pollution on fish and other fresh-water life is another important problem to be studied. The Bureau of Fisheries has been conducting field investigations in the upper Mississippi River for the purpose of determining the effect of the new 9-foot channel which is being constructed in the river. Dams are to be built at intervals all the way from St. Paul to St. Louis, and the Bureau of Fisheries officials want to know just how that will change conditions for life in the waters.

NEW WHEAT VARIETIES FROM RUSSIA

NEW varieties of grain from the oldest wheatlands of the world have been brought to the U. S. Department of Agriculture by Dr. J. D. Dickinson, who has just returned from a half-year's botanical exploration of the Caucasus region and other parts of Russia. On these great plateau grasslands, where wheat has been grown for many centuries, Dr. Dickinson found species of wild wheat growing side by side with cultivated varieties.

In his search for grain varieties which may be useful in America, Dr. Dickinson had the assistance of leading Russian economic botanists. One of the Russian scientists has identified seven distinct forms of wild wheat in the Caucasus region, which he regards as separate species. He has also found three species of wild barley.

One wheat variety grown on the Caucasian highlands appears to hold great promise. It is known in Russia as Persian wheat. It is a short-stemmed, heavy-headed variety, maturing in a remarkably short season and being able to grow successfully in cold soil. The peasants follow the receding snow fields in spring, sowing this wheat along their margins as they melt. The yield is reported to be as much as fifty bushels per acre.

Dr. Dickinson also collected a considerable quantity of the native fruits, especially apples, pears and cherries. These grow as wild forest trees in the Caucasus, sometimes reaching great size. He reports that he saw pure stands of wild apples several hundred acres in extent. The fruit of these wild trees varies considerably in quality. Some of it is very disagreeable to the taste, but much of it is really very good.

PRESERVATION OF THE TURKEY

THE price of turkeys may be high, but if it were not for scientific work the Thanksgiving bird could not now be had for any money. Department of Agriculture scientists have told *Science Service* the story of the rescue of the domestic turkey from threatened extinction.

Some years ago, the business of turkey-raising was being rapidly wiped out as the result of the ravages of a disease known as "black head." It attacked the digestive tract and liver, and the birds seemed to have no resistance to it whatever. It was doing more than decimating the flocks; it was wiping them out altogether.

In 1895 Dr. Theobald Smith, now of Princeton University, but then one of the rising young men of the Department of Agriculture, identified the germ of the disease. It was shown to be a parasitic protozoon, or one-celled animal. The pest attacked first in the digestive tract, and then worked its way into the liver, eventually causing the bird's death.

But though the cause was known there seemed to be no method of cure or prevention. Then, about ten years ago, Dr. E. E. Tyzzer, of Harvard University, showed that the same germ is harbored by common chickens. These, however, are quite resistant to it, never becoming very sick but serving as semi-immune "carriers." Turkeys kept in mixed flocks with chickens were therefore practically certain to become infected if there had ever been a case of black head in the history of the flock.

The salvation of the turkeys was accomplished by the simple expedient of segregating them from the chickens thus found to be such bad company for them. This has not by any means eliminated the disease, but it has at least made it possible to keep the turkey flocks alive. In the meantime the Department of Agriculture is attacking the problem anew, with the object of finding a positive and specific method of prevention or cure.

ITEMS

TEMPERATURES that ordinary animals and plants could not endure for more than short periods are built up and apparently enjoyed by the fungi that breed in piles of rotting straw. Experiments at the Rothamsted Experimental Station near London show that these organisms of decay thrive best at a temperature of about 130 degrees Fahrenheit, which is more than halfway from freezing to boiling point. These fungi, it has been found, do more than the bacteria often found associated with them toward the reduction of straw to a soil-enriching fertilizer resembling farmyard manure.

PORTABLE sound movie equipment, using the narrow 16-millimeter film now standard for amateur cameras and projectors, has been developed by the Westinghouse Electric and Manufacturing Co. The Society of Motion Picture Engineers heard at the recent meeting an account of this equipment, for which C. R. Hanna, P. L. Irwin and E. W. Reynolds are responsible. The only difference between the sound film and the ordinary kind of the same size is that in the former one row of sprocket holes is omitted to make room for the sound track, the record being made right on the film as in most of the theater methods. Like the large film equipment, the light from a small lamp shines through this sound track, then it is analyzed by a photoelectric cell, and converted into electric impulses. These in turn operate the loud speaker. The entire equipment can be carried in three cases, one for the projector, one for the amplifier and one for the loud speaker and screen. Together they weight 120 pounds.

QUARANTINE restrictions on Florida fruit and vegetable shipments, designed to protect the rest of the nation against the menace of the Mediterranean fruit fly, have been wholly removed, effective November 15. This restores Florida to complete parity with other states so far as shipment of these products is concerned. The decision of the U. S. Department of Agriculture to lift the fruit fly ban followed conferences with Florida officials, including Governor Carleton and members of the state plant board. It marks the end of a war of man against an insect that began in April, 1929, when the dreaded pest was discovered in orchards near Orlando, in the heart of the citrus belt. Since November 16, 1929, no infestation has been found in a commercial orchard, and only two isolated finds have been made elsewhere.

SCIENCE NEWS

Science Service, Washington, D. C.

INTERRELATIONS OF CLIMATE IN INDIA AND CANADA

WHY unusually dry summers in India mean mild winters for Canada six months later and wet summers in India foretell hard, cold winters in Canada is a mystery calculated to tax the ingenuity of U. S. weather experts to explain data recently received from Fred Groissmayr, of Passau, Germany, and Dr. C. F. Brooks, of Clark University.

Examining weather reports for a period of 44 years, Mr. Groissmayr found a remarkable correlation between climates separated by oceans of distance and months of time. Throughout all the period studied when India was unusually wet or dry, winters in Saskatchewan and Alberta have been below or above normal in temperature with but four exceptions.

Measuring the other factors of the Indian climate which might be significant in determining the Canadian winter, Mr. Groissmayr also charted the temperature in various portions of India. Unusually cool autumns in northwest India were always followed by a severe winter at Winnipeg.

Such decided relations led to further study of tropical factors influencing Winnipeg's winters and indicated that not only India's monsoon, but also the flood of the Nile in Egypt, have a measurable effect on distant Canada, while high pressure over India, Egypt and Batavia was later reflected by correspondingly high temperature in Canada. Thus the highest India pressure of 1877 was followed by the mildest winter at Winnipeg. And throughout the period studied, temperature maximum in India was associated with highest temperatures over an immense part of Canada and of the United States as well.

Dr. C. F. Brooks, of Clark University, recommended the findings of Mr. Groissmayr to the attention of Canadian and U. S. Weather Bureau meteorologists. He said: "The extraordinarily high correlation found by Mr. Groissmayr between pressures, temperatures and rainfall of certain tropical regions and the later winter temperatures in the interior of Canada challenges North American meteorologists (1) to test Mr. Groissmayr's claims by applying his formulas to the years after the period he used in making them, (2) to study the physical basis for such a correlation and (3) to explore other possibilities not only for predicting winter mean temperatures but also for other seasons and for all parts of the continent."

In *The Monthly Weather Review* of November, 1929, Dr. Brooks predicted on the basis of the Indian summer that the average temperature in Winnipeg from December, 1929, to February, 1930, would be slightly above normal. Reports subsequently obtained from the Canadian Meteorological Service proved this forecast, based on Groissmayr's formula, to be correct.

This forecast of a Canadian winter is the sixth which Dr. Brooks has made on the basis of the previous summer in India. Of these six, two were nearly perfect, two reasonably successful, one good and one poor.

One of Dr. Brooks's students is now engaged in formulating a forecast of the weather in store for Winnipeg during the winter of 1930–31.

A NEWLY DISCOVERED SUBMARINE VALLEY

TRANSATLANTIC liners now have a new "landmark" to guide them when approaching the American coast, with the discovery of a previously unknown submarine valley in the Georges Bank. This bank runs eastwards from Cape Cod for about 200 miles and the valley is near its eastern end.

Following the earthquake of November 19, 1929, off Newfoundland, which disrupted cable communication, Captain Bone, of the *S. S. Transylvania,* made a sounding to check his position, and found a much greater depth than anything suspected in the vicinity. At first it was suggested that the rift had suddenly appeared as a result of the quake. During recent months the U. S. Coast and Geodetic Survey's survey ship, *The Oceanographer,* formerly J. P. Morgan's yacht, *The Corsair,* has resurveyed the region.

Using the sonic depth finder, which measures ocean depths by the time required for a sound wave to reach the ocean bottom and return as an echo, they found a valley about 8 miles long and 400 fathoms (nearly half a mile) deeper than the surrounding ocean floor. The normal depth in this region is about 100 fathoms.

The survey work was done with the aid of the radio compass. By this means the position of the ship at all times was accurately checked, and it was found that the valley was more than 500 miles away from the epicenter of the earthquake, and the point where the cable breaks occurred. For this reason it is believed that the valley has nothing to do with the quake, apparently it has been there for a long time, but with no careful surveys of the region having been made in the past, its existence was unknown.

Many modern ships, especially the large liners, are equipped with sonic depth finders, so that a sounding can be taken in a few seconds, instead of the much longer time required when a line had to be lowered and hauled in again. For this reason accurate depth surveys are important. Thus it will now be possible for a navigator, when entering the region of the Georges Bank, to tell his position closely, if he finds a sudden drop below him of 400 fathoms.

NEED OF EARLY DIAGNOSIS OF CANCER

PEOPLE generally do not yet know how valuable the X-ray is in detecting disease of almost any part of the body in its early stages, when the chance of cure is greatest, said Dr. Joseph Colt Bloodgood at the meeting in Los Angeles of the Radiological Society of North America. He called on the medical and dental professions to give the public this knowledge.

"It is time for the united, highly educated members of the medical and dental profession to let the people know through the press that at the present time there is no cure or management of cancer, except surgical removal with or without irradiation, or irradiation alone," he said. "The cure of cancer depends upon getting the correct information to the people and getting the people quickly to this triumvirate of medical skill." The triumvirate, he explained, consists of accurate diagnosis, experienced and skilled operators and properly trained radio-therapeutists.

In speaking of cancer cures, he said: "There is no evidence of any five-year or permanent cure of cancer by any treatment other than surgery or irradiation, which can not be explained either by the fact that the condition was not cancer, or the individual lived longer than the usual age duration of the cancer in his or her body.

"There has always been great competition in the treatment of cancer and the world has never been free of individuals within and without the medical profession who have claimed cures. If one of them had been a real cure, there would be no cancer in the world to-day, because some of these cures have been tried for centuries."

Cancer, however, is not the only disease in which X-rays have proved their usefulness. Dr. Bloodgood pointed out other conditions for which they are valuable. "The moment there is any change in a bone, either of bone formation or bone destruction, it will show in an X-ray plate. Every individual, even a child in the primary school, knows what is meant by pain or discomfort in any part of the body—and in every part of the body there is a bone. If there is a tender spot it is appreciated at once, even a slight swelling is rarely overlooked. Now the public should know that these insignificant first warnings may be the earliest signs of some trouble in a bone, and the only means of immediate protection are the X-rays.

"Too many individuals and parents have resorted to domestic remedies—poultices, mustard plasters. The day of domestic remedies is over. The day of prescribing by the druggist should be over.

"Everyone should know that a root abscess may be present in a tooth without pain or swelling. There may be no gum boil or looseness of the tooth. The blood poisoning from that root abscess may cause rheumatism, indigestion, heart disease and many other troubles. It is good protection to have X-rays taken of your teeth at as frequent intervals as your dentist suggests."

Dr. Bloodgood also explained the value of X-rays in making early diagnosis of tuberculosis, gall bladder and kidney disease, cancer of stomach or intestines as well as cancer in more accessible parts of the body.

X-RAYS AND TUBERCULOSIS

POWERFUL, searching X-rays can find early signs of tuberculosis of the lungs, even before the victim appears to be ill, members of the Radiological Society of North America meeting at Los Angeles were told by Dr. Karl E. Koenig, of Seattle.

This is particularly important in detecting tuberculosis in children. Medical authorities know that tuberculosis of the lungs may be present for months and even years before there are definite symptoms and that an adolescent child may be apparently healthy, physically active and even overweight and yet may have tuberculosis in a serious form. X-ray examination is very valuable in such cases, as evidences of tuberculosis are found in X-ray plates in its early stages.

X-ray plates indicate the progress of tuberculosis. They are valuable as permanent records and also for making comparisons of X-ray plates recently taken with plates taken three or six months before. When tuberculosis of the lungs grows worse the shadows on the X-ray plates grow larger or evidences of cavities may appear.

If there is improvement the shadows gradually grow smaller, but never disappear entirely even if the patient completely regains his health, as scars due to tuberculosis of the lungs remain throughout life. The shadows caused by pneumonia disappear in a few days or weeks and they leave no scars.

To-day the physician uses his eyes and not his ears in diagnosing disease in the lungs. For a long time the stethoscope was used to listen for unusual sounds in the lungs. To-day disease is shown on X-ray plates by dense shadows.

ENGINEERING REVISION FOR SAFETY

EDUCATIONAL campaigns in safety, startling posters and the like have their place in preventing accidents, but there is another form of accident prevention which has already greatly reduced accidents and still has limitless possibilities. It is engineering revision.

By engineering revision is meant buildings designed for health and comfort, well arranged transportation facilities, ready and safe access to every place workers are required to go, adequate and well-arranged lighting and safeguarding of machinery, Lucian W. Chaney, expert in accident prevention of the U. S. Bureau of Labor Statistics, told members of the American Society of Mechanical Engineers at their annual meeting in New York.

With bare statistics Mr. Chaney showed where engineering revision has greatly eliminated accidents and where unnecessary lives have been lost because of the lack of safe facilities.

"In blast furnaces hot metal breakouts contributed to the severity rate more largely than any other cause in the early years," he said. "By 1910 this cause had practically disappeared. The change was due to structural changes which increased the resistance of the furnace to such an extent as to eliminate the breakouts."

Mr. Chaney found that in a special study of accidents causing 372 deaths, 212, or 57 per cent., could have been prevented by some form of engineering revision. "This can be said without qualification," he declared. "It can not be said, however, that all the other 43 per cent. would have been amenable to educational methods in response to which caution would insure safety. In only about 10 per cent. of these deaths would it be safe to say positively that the man's own carelessness clearly appears as the major factor."

"It is certainly possible," he concluded, "to imagine structures and apparatus so strong, so well designed, so intelligently operated, that failure and consequent death will be the rare exception. The possibilities of improvement from the engineering standpoint are almost limitless."

GAME ON FARMS

MAKE landowners really interested in the conservation and increase of game birds and animals by paying them for the labor and materials used in their care. That is the core of a new game policy advocated by a committee of the Seventeenth Annual American Game Conference, which opened its meeting in New York on December 1.

The policy of protecting and colonizing game on lands unsuitable for farming or other commercial uses is admirable so far as it goes, but this policy is good only for this class of cheap lands. High-priced farm and commercial forest lands are necessarily too much subjected to human management to permit game development under natural conditions. It is not fair to expect the owners to divert part of the land use, and therefore potential revenue, to game raising unless a corresponding compensation is made to them. This policy is now being tried out on an experimental large-scale basis in one county in Michigan, and is said to have given good satisfaction there.

The committee also advocated the extension of public ownership and management of game lands as fast as funds and land prices permit, the training of men for the special task of game administration, the study and utilization of the natural factors that produce game abundance and the extension of game protection interests to include the scientist and the non-hunting protectionist. It called for the redistribution of the cost of game administration, now taken care of almost wholly from license fees. It was the sentiment of the committee that since much wild life not properly classifiable as game is taken care of at the expense of the game administrations of the various states, there should be some contribution from the general tax funds in addition to the revenue derived from shooting licenses.

ITEMS

BLACK satiny surfaces and festooned skins of lava on a boiling lake of liquid stone are the latest phases in the eruption of Kilauea's inner pit, according to a statement made by Professor T. A. Jaggar. The first manifestation of activity in the present eruption was the outbreak of a number of lava fountains through last year's lava floor in the pit. These rapidly filled the bottom area with new lava activity, which finally centered at a single fountain with a lake northwest of it. The material was brown pumice and sulfur gases, with spurts 200 feet high. Occasionally the flows across the floor developed both smooth and clinker lava phases. The lake built up its border until it stood on top of a slag heap more than 100 feet high, with larger flows continually moving down two long slopes on the side farthest away from the source fountain. The fountain built up a half-ring of rampart wall of spattered lava, to the south of itself. This rampart kept breaking down on the side toward the fountain. The fountain continues its flow unceasingly and with undiminished strength. The present surface of the lake is about 950 feet below the rim of the pit. A new lava field, 2,000 feet across and shaped like a leaf, has been formed. The eruptions continue with an unceasing inflow of lava.

THOUGH the Japanese earthquake on November 26 was destructive of life and property, it was not nearly as severe as the Tokyo quake of 1923. This is indicated by the rather meager instrumental records of the quake obtained on American seismograph instruments. The reports from the North American continent were not sufficiently complete to enable the earthquake experts of the U. S. Coast and Geodetic Survey to locate the center with precision. Even if there had been no reports directly from the damaged area, they could at least have located it in Japan, but because of its great distance the center could not be located as accurately as is sometimes possible. The amount of damage by a quake is no criterion of its severity, as many of the world-shaking quakes, felt on seismographs all over the earth, occur at sea and do no damage whatever. On the other hand, a mild quake, if centered in a thickly settled region as in Japan, where there is an abundance of lightly constructed buildings, may result in great damage and loss of life.

THE nodule bacteria of alfalfa roots, capturers of air nitrogen and builders of soil fertility, are active wanderers during their younger days, before they settle down to their life work. Bacteriologists at the Rothamsted Experimental Station have taken advantage of this fact to secure better infection of alfalfa seed before planting. The bacteria go through a series of life stages much like those of some aquatic animals, being free swimmers while they are young and sessile when they mature. When they grow old their cell contents assume a banded appearance, then break up into tiny globular bodies. These latter elongate into rodlets which at first have the power of motion. By encouraging these swarming youthful wanderers with a diet of milk and phosphates, it is possible to secure a much better inoculation of alfalfa seed.

POOR vision makes you more likely to get sick when riding on cars or in automobiles, although car sickness is based on irritation of that part of your ears known as the labyrinth, Dr. J. E. Lebenhohn reports in the *Archives of Ophthalmology*. This distressing condition is becoming less common, however, as a result of smoother roads, easier riding cars and automobiles. People who have faulty vision or eye muscle balance are more easily nauseated if they have a digestive tract especially susceptible to further depressing influences. An empty stomach is particularly sensitive, so it is best not to fast when traveling.

SCIENCE NEWS

Science Service, Washington, D. C.

ANNUAL EXHIBIT OF THE CARNEGIE INSTITUTION

RESEARCHES ranging from the sunlight-capturing mechanism of plants to the structure of Maya pyramids are to be graphically presented to the public at the annual exhibit of the Carnegie Institution of Washington. The exhibits will be on display during the afternoons and evenings of December 13, 14 and 15.

A prominent place in the exhibits will be given to studies now in progress on the utilization of the sun's energy, particularly as it is gathered by plants and later released again by man for his use in food or fuel. The speed at which modern civilization is burning up the millions of years of stored sun-power accumulated in coal and oil is giving much concern to scientists, who foresee a day when the world will have no more fossil power and will have to catch its power directly from the sun as it comes every day. When that time arrives, we shall need much more efficient energy-catchers than we have at present. The best present solar energy capturers are green plants, and their efficiency is rated at only one or two per cent. For this reason, one department of the Carnegie Institution is making fundamental researches into the utilization of solar energy.

What we ourselves do with the energy stored in foods is the subject of research in another department of the institution. This will be illustrated in an exhibit on basal metabolism. Basal metabolism is the energy conversion rate of the human body when resting quietly, several hours subsequent to the latest meal. The tests are usually made before breakfast. Basal metabolism tests have come to be of great importance in medicine.

Another exhibit will show motion pictures of the movements of wandering cells in the body. There will also be an exhibit demonstrating important discoveries made during the past year on the effects of glandular secretions on the development of hereditary characters. Still another will show how living cells transmit electric currents.

The year's progress in the excavation and restoration of the splendid Maya ruins in Yucatan and Central America will be shown in pictures and models. The outstanding individual pieces of work in this field during 1930 have been the rebuilding of the "Caracol" at Chichen Itzá, which was probably an astronomical observatory as well as a temple, and the discovery of an early pyramid hidden within a later one, at Uaxactún.

In the exhibit arranged by the Geophysical Laboratory, the story of how the crystals in rocks can be made to tell something of the way they came into being will be told, with side-lights on the general physical behavior of heated crystals.

ATHENAEUM AT PASADENA

THE new Athenaeum of the California Institute of Technology, built at a cost of $500,000, has been completed and opened. The whole building is devoted to the social interests of the California Institute of Technology, the Mount Wilson Observatory and the Huntington Library and Art Gallery, to serve as a gathering place for scholars and visiting scientists, the staffs and research students of these institutions. It has already a membership of four hundred.

The building, designed in Mediterranean architecture to harmonize with the other structures of the campus, has a spacious lobby, a large, beautifully appointed lounge, several small dining rooms and one seating one hundred and fifty people. These may be thrown into one for important banquets, and adjoining them is a salon-hall known as the Hall of Associates, in which weekly lectures and demonstrations will be held as well as more social functions.

The second floor provides twenty-four bedrooms and four corner-suites, furnished with every possible comfort. In the Hall of Associates are twenty-six lunettes in which will be placed the arms of learned societies, academies and universities. Furnishings and draperies have all been especially designed. Three sides of the Athenaeum surround a patio with loggia and Florentine arches bordering it; while sleeping porches, tennis courts and a sixteen-car garage are also provided.

A carefully planned program of lectures includes an illustrated lecture by Dr. John A. Anderson on the progress being made with the 200-inch telescope. Dr. Robert A. Millikan speaks on "Benjamin Franklin and the Beginnings of Electrical Theory." Well-known scientific men from abroad, already at Pasadena for protracted visits, will be heard during the winter, but only by members and associates and their friends.

THE CONSTANT OF GRAVITATION

THE final value for the most accurate measurement ever made of the constant of gravitation, from which can be figured the mass of the earth and the force with which the earth pulls the moon, has now been determined by Dr. Paul R. Heyl, physicist of the Bureau of Standards, after seven years' work.

Speaking on December 6 before the Philosophical Society of Washington, he announced that the value can be expressed by the fraction 6.670 over 100,000,000. A full technical account of his work will be published in the forthcoming December issue of *The Journal of Research* of the Bureau of Standards.

According to Sir Isaac Newton's law of gravitation, any two bodies in the universe attract each other with a force that is greater as they are more massive and less in proportion to the square of the distance separating them. The exact force is obtained in scientific units by multiplying together the two masses, dividing by the square of the distance between them and multiplying the result by the constant of gravitation. Accurate knowledge of the force of gravity is important in many

branches of science, from the study of the paths of projectiles fired from guns to that of the motions of the stars. The physicist refers to the constant as G.

The first effort to determine G was by a Frenchman, Pierre Bouguer, in 1740, but success was not attained until 25 years later when an English astronomer, Rev. Nevil Maskelyne, found the attraction of a Scottish mountain, Schiehallien, which has a short ridge running east and west and steep sides on the north and south. He observed a plumb bob on each side of the mountain, and, by comparisons with the stars, measured the amount that the mountain pulled the plumb line from the vertical. This value was only a rough approximation, however, because it was not possible to find with precision the mass of the mountain.

In the years 1797 and 1798, an English physicist, Henry Cavendish, first performed the experiment with small, known masses in the laboratory. With this method, two tiny balls are attached to the end of a little rod, the rod is balanced at the end of a long thin wire. As two large masses of metal are brought near, the small balls are pulled towards them and the wire is twisted. A tiny mirror attached to the wire near the rod turns with it, and moves a spot of light reflected from it to a distant screen. Essentially this is the method used in the new determination at the Bureau of Standards.

The largest masses used by Dr. Heyl were steel cylinders weighing about 150 pounds each. The smallest were balls of gold, platinum and glass, each weighing about two ounces. Though the attraction that the large masses exerted on the small ones was about the same as the weight of the ink in the period at the end of this sentence, this force was measured with an accuracy of a thirtieth of one per cent. Instead of merely measuring the displacement in the position when the large masses were far away and when they were near, Dr. Heyl set the small masses swinging back and forth and measured the time of their swing. This period of oscillation changed as the large masses were brought close.

Dr. Heyl's work has been largely inspired by Dr. G. K. Burgess, director of the Bureau of Standards, who had a personal interest in the problem. In 1901, when he was working for his doctor's degree at the Sorbonne, in Paris, Dr. Burgess did the experiment for his thesis, and obtained 6.64 for the value of G. However, the work was done under pressure of time, and he was not satisfied with the result. Then, when he became director of the bureau, he saw to it that the experiment was done more accurately than ever before so the problem was assigned to Dr. Heyl, and he was given plenty of time and the best facilities.

In 1927 Dr. Heyl announced a preliminary value for the figure, of 6.664, but then the work had only been done with the small balls of gold and platinum. Since then he has repeated the work with the glass balls, and these gave a somewhat higher value, so that the final figure, the mean of all three, is 6.670. Dr. Heyl attributes the difference to small experimental errors in the set-up, and not to any difference in the gravitational attraction for different materials. Experiments made some years ago by Baron Roland von Eötvös, a Hungarian physicist, showed very conclusively that there is no difference depending on material.

TELEVISION AND SOUND BROADCASTING

TELEVISION will now be able to follow the movies and "go sound" if recommendations made by leading television engineers are adopted by the Federal Radio Commission. The commission asked the views of those who are now putting sight as well as hearing into radio.

Until now most of the lookers-in, who are equipped with televisors and can get the signals from one or more of the eight stations that are regularly putting such programs on the air, have enjoyed silent pictures only. In a few cases, special authority has been granted broadcasters to use a general experimental wave-length for simultaneous sound broadcasting, and others have been sending out for the benefit of ordinary listeners the sound through a regular broadcasting station when the sound part had entertainment value by itself.

The present television broadcasting channels are 100 kilocycles wide, ten times the width of those used for sound broadcasting. It has been suggested that part of the television bands be set aside for simultaneous sound, but this idea was not favored by the broadcasters. It was decided, however, that the commission should allow television stations to use part of their bands for the purpose. Since future development may require even wider bands, it was also decided that a separate frequency, or wave-length, should be made available over which the television picture could speak.

One possible solution of the problem as to how enough space in the radio spectrum can be provided for adequate television seems to be the use of waves far shorter than any that are now used ordinarily. The television broadcasters urged that several bands of these very short, ultra-high frequency bands should be assigned for television. The bands selected, as not yet being otherwise assigned, are from 43,000 to 46,000 kilocycles, 48,500 to 50,300 kilocycles and 60,000 to 80,000 kilocycles. In wave-length, these are around six meters, which corresponds to 50,000 kilocycles. The present television bands are between 2,000 and 3,000 kilocycles.

In order to prevent stations interfering with each other the broadcasters also recommended that stations should not be allowed to operate at the same time within the same channel if less than 150 miles apart, except by mutual agreement. As some stations do not use the full band of 100 kilocycles, by arrangement among themselves the stations will be allowed to use different parts of the same band if they make mutually satisfactory arrangements.

In spite of the technical advances made, television is still very much experimental. This is the general opinion of those broadcasting. C. W. Horn, general engineer of the National Broadcasting Company, expressed this viewpoint when he stated that "the amateur can not be considered at present, and, except in small areas around

a station, it is impossible to guarantee any regular service.''

CELL STRUCTURE

ULTRA-MINUTE details of cell structure never before seen are now made visible through the use of a new type of microscope. Professor William Seifriz, of the University of Pennsylvania, described the instrument and its work in a recent lecture. Structures on the cell wall and in the living protoplasm itself one fifty-thousandth of an inch or less in width can now be examined and measured.

The secret of the new microscope is a tiny mirror of gold or platinum deposited on the inner side of the lowermost lens, in such a way that it reflects light directly downward on the object to be observed. The light is reflected back again from the object, enters the lens around the sides and passes upward to the eye of the observer. It is the invention of a Swiss scientist, Charles Spierer, who has carried on some of his researches in cooperation with Professor Seifriz.

Under the intimate illumination made possible by this mirror-bearing lens, the inner layer of a plant cell wall is shown to have a structure as though it were made up of a multitude of exceedingly fine rods, like a close-set pole fence. These are termed ''micelles,'' and are believed to be made up of bundles of carbohydrate molecules, which are too small to be visible by any microscopic treatment.

Living protoplasm shows a similar structure, of fine, closely parallel strands or fibers, with thickenings on them in places, in a more uniform background of gray substance. The two structural types are so similar in appearance that it is hard to tell them apart, Professor Seifriz says. However, he is not ready to commit himself to the opinion that the solid stripes of the non-living cell wall are due simply to a direct hardening or precipitation action of the fluid, living protoplasm. The settlement of this and other questions raised by the fine details made visible by the new lens, he says, must await further research.

ITEMS

A SURVEY in Pennsylvania, by J. E. Aughanbaugh, of the commonwealth's Forest Research Institute, indicates that there is hope for the native American chestnut. For the first time in twenty years, moderate quantities of chestnuts have been gathered. While the total is the merest fraction of the pre-blight chestnut crop, still it is regarded as a triumph that there are any American chestnuts at all left to be harvested. Mr. Aughanbaugh is hopeful that a goodly proportion of the sprouts may retain their apparent immunity to the fungus that blighted the original trees, and even that this immunity may be hereditary, so that it can be transmitted to a new generation of seedling trees that will sprout from some of the nuts now being produced.

THE supposed ''prehistoric animal'' reported to have been discovered preserved in ice in Alaska is almost certainly a whale. Dr. Barnum Brown, of the American Museum of Natural History, New York, advised *Science Service* that the reported presence of flippers and the dimensions of the skull indicate the carcass is that of the familiar mammal of the sea. Scientists of the U. S. National Museum, Washington, also express the same opinion.

A NEW hot spring came into existence at the Hot Springs National Park, recently, when workmen were cleaning out the old springs and installing new pipe lines. While workmen were leveling off a trench to carry away the flow from one of the springs, a projection was found in the bottom of the trench which interfered with the proper level for the pipe. To remove the projection a laborer struck it about half a dozen times with a pick, and then a stream of hot water gushed into the trench. Dr. Hugh de Valin, park superintendent, states that this spring is one of the hottest in the park, and that it is expected to have a flow of from 50 to 60 gallons per minute. It will be included in the collecting system through which the hot waters are gathered for distribution.

STEAM vents that change not only their form but their location are a frequent occurrence in Lassen Volcanic National Park, California, an area that contains the only volcano on the United States mainland that is known to be semi-active. Two outstanding examples of such change occurred recently. The vent known as the ''Big Steamer'' in the Sulphur Works area became plugged with mud and débris. This resulted in an increase of steam and pressure beneath, which caused it to blow up and scatter mud a distance of 40 feet around the vent. Now it is a large boiling spring, having changed its form after the explosion and in addition migrated several feet to the west. Another large steam vent in the southeastern end of the Devil's Kitchen has become a boiling pool about 10 feet in diameter. It now boils constantly, raising the main body of water to a height of four or five feet and occasionally sending jets up to a height of 10 feet.

DEVELOPMENT of a new method of fumigating grain in storage without incurring a fire hazard is an outstanding achievement of government investigators during the past year, according to the report of Dr. C. L. Marlatt, chief of the Bureau of Entomology of the Department of Agriculture. The new fumigant is a mixture of solid carbon dioxide or ''dry ice'' and ethylene oxide. Tests by commercial handlers of grains have proved the value of the method, which is economical and superior to the more familiar carbon disulphide treatment of grain, due to its non-inflammability.

BETTER and healthier farm animals are stocking American farms at the end of 1930 than ever before in history, the annual report of Dr. John R. Mohler, chief of the Bureau of Animal Industry of the U. S. Department of Agriculture, indicates. This progress is attributed to the increasing use of purebred sires and the activities of breeders who are supplying improved types of animal in sections where the diseased and unthrifty stock are being condemned and culled. The bureau has contributed to this improvement through its activities in combating stock diseases, whose control has encouraged farmers to invest in better stock.

SCIENCE NEWS

Science Service, Washington, D. C.

THE DISTRIBUTION OF ISLAND GALAXIES THROUGH SPACE

As far as the largest present-day telescope can reach into space—a distance of 300 million times the six trillion miles that light will travel in a year—there are uniformly scattered a total of 30 million island galaxies. Each of these is a system of stars similar to the Milky Way system, of which the Sun, and all the other stars that we can see, are part. Further, the space between them is perfectly transparent, at least as nearly as we can judge.

In a report to the Carnegie Institution of Washington, Dr. Edwin P. Hubble, of the Mt. Wilson Observatory, tells his latest researches in studying these objects, the most distant observed by astronomers.

On the average, he has found, the distance between neighboring nebulae is about 1½ million light years. Many of them are arranged into clusters, but, if large volumes are considered, their distribution is uniform. This was learned by a study of photographs made with three different telescopes, including the Mt. Wilson 100-inch, the world's largest. With so many objects, they may all be assumed to be of the same brightness, and the photographs showed that when nebulae four times as faint were recorded, there were eight times as many. As the faintness of a nebula varies not with the distance directly, but with its square, one that is four times as faint as another must be at twice the distance. Therefore, the number of nebulae vary with the cube of the distance, and this means that they are uniformly distributed.

Dr. Hubble also considered the question of what is beyond the observable region. Of course, larger telescopes, such as the 200-inch now under construction at Pasadena, will reach still farther, but does the uniform distribution of galaxies hold indefinitely?

"There is no evidence of a thinning out, no trace of a physical boundary," he said. "The universe, we must suppose, stretches out beyond the frontiers, and for a while, at least, the unknown regions are probably much like the known. This is a legitimate extrapolation, but it can not be pushed indefinitely. An infinite homogeneous universe is not compatible with the observed darkness of the sky and the stability of the stellar systems. Yet, if the universe is not homogeneous, then the observable region is not a fair sample and extrapolations lose their significance.

This dilemma can be escaped by means of the theory of relativity, which assumes a closed universe with a finite volume, but no boundaries, something like the surface of a sphere. This fits in with the apparent high velocities observed for some of the more distant galaxies. One cluster, in the bowl of the Great Dipper, is at a distance of 75 million light years, and seems to be receding at a speed of more than 7,000 miles a second.

This apparent speed can now be used to measure nebular distances, but Dr. Hubble expressed the view that it is not a real speed. Instead, it is probably a consequence of the curvature of space, in some other than our three dimensions. As an analogy, Dr. Hubble mentioned a map, in two dimensions, of the curved surface of the Earth. If a small area is represented, the flat map differs little from the curved Earth, and it is fairly accurate. But if the whole Earth is represented, the parts away from the center of the map are greatly distorted.

THE USE OF CHRISTMAS TREES

THE Christmas tree, center of the Yuletide celebration ever since our half-barbaric forefathers feasted in the forests of Germany, threatened as the result of present-day need for conservation of timber, has received a new lease of life.

Within reason, says the U. S. Forest Service, Christmas trees may be used without danger to America's chances for recovery of her vanishing forests. Indeed, the use of Christmas trees may even aid in that recovery.

For in man-helped forests as in naturally propagated ones, many more young trees must be started than ever have a chance to grow to full maturity. A few years after a burn or a landslide, the swept area may be thick with saplings "like hair on a dog's back." And foresters imitate more or less this thick-planting tendency of nature.

But as the little trees grow up they all demand room to spread their branches, and if they are all left standing they will push and elbow each other. A stand of saplings left unthinned will grow up into a weed-patch instead of useful timber, full of slim, spindling trees whose trunks might be good for fishing poles but not for much else.

So the foresters have to go in and select the young trees that are to be the timber, and ruthlessly cut out all others. Hundreds of thousands of young evergreens are thus eliminated every year. They used to be heaped up and burned to get rid of them, but with the advancing price of Christmas trees it has become better economy to go to the further labor of transporting them to market. The sale of the little trees that are doomed anyhow thus helps to finance the new forests.

There is a distinct hierarchy of preference in the Christmas tree field. By far the heaviest favorite is the spruce. There are several species, but they all look pretty much alike to the layman, and they are alike for Christmas-tree purposes. They have short, stiff, prickly needles, pretty completely covering their twigs.

Another kind of tree that is a favorite on the Christmas market when there is a supply is the fir. This looks a good deal like the spruce, but its needles are curved and softer than spruce needles, and are not prickly to handle. When it has cones, they stand up like thick candles, whereas spruce cones are smaller and hang down. Firs often have drops of sticky resin on them, which gives them the alternate name of "balsam."

Where spruces and firs are not abundant, notably in the South, little pines are used a good deal. Several species of pines grow in the poor soils of the barrens and on rocky ledges, and especially in the lowlands where spruce and fir do not venture in the South.

Even more of a favorite than the pines, in the non-spruce areas, is the red cedar or Virginia juniper. This has the advantage of being more compact and symmetrical than a young pine tree. Its twigs are also better clothed with their short green needles, giving a more uniformly green appearance.

Almost all other species of evergreen also have their users, and occasionally in the South or in California one even sees little palm trees drafted. But where people can get it, the spruce tree, the original "Tannenbaum" of the old German celebration, remains the favorite.

CULTIVATED HOLLY

HOLLY is a profitable crop, and is going to be more profitable, in the opinion of P. L. Ricker, of the Wild Flower Preservation Society. Our native American holly, once abundant from Florida to Cape Cod, is now hardly to be found north of the New Jersey line, thanks to the unrestricted depredations of commercial holly gatherers. In their eagerness to realize a cash return now they have been sacrificing the next generation's Christmas decorations, and there is not much prospect of any effective check on their operations until they themselves have killed their goose that lays golden eggs.

The foresighted owner of waste land in any region where holly grows naturally can take advantage of the shortage that is sure to come by planting holly now. It takes about eighteen years for a holly plantation to come into best bearing, but after that, with decently conservative cutting, it will be good indefinitely.

The best method of propagating holly, Mr. Ricker says, is by cuttings. They should always be made from the best berry-producing trees. Production from seeds is hardly practicable, for holly seeds are uncertain and slow to germinate, produce only about ten per cent. of female, or berry-bearing plants, and even these are of uncertain productivity. Cuttings insure a continuance of the same qualities in the offspring that are found in the parent tree.

After the cuttings are rooted in boxes in the greenhouse, they are to be set outdoors in rows two feet apart, the plants two feet apart in the row. When the bushes are about six years old, every other row is to be cleared out, and also alternate plants in the remaining rows. A ready market can be found for small potted holly bushes, to absorb these thinnings. The remaining bushes are allowed to grow up and bear their seeds. About one bush in ten should be started from a male cutting. These plants have no berries, but they produce the pollen without which the female plants can not bear fruit.

For one restricted region, along the coast from the Patuxent River in Maryland to Norfolk in Virginia and inland for about fifty miles, Mr. Ricker recommends the planting of English holly. This has glossier leaves and larger berries than American holly, and commands a better price in the market. Outside of that area, he thinks, climatic limitations are likely to prevent the successful raising of the English species, though the hardier and more versatile American holly will thrive throughout the Southeast, with a considerable extension up the coast toward New England.

NATIONAL BEACHES

A SERIES of national beaches, analogous to the national parks, was advocated by J. Spencer Smith, president of the American Shore and Beach Preservation Association, at its annual meeting at the National Research Council on December 12. The association exists for the study of the opportunities presented by the shore and beach lines of America, and for the recommendation of means of solving the problems to be faced in preserving suitable beach areas for public recreation and scientific study.

Mr. Smith advocated the acquisition of such areas by local interests and their assignment to the federal government for administration and development. He said, in part:

"The preservation of our beaches is essentially a national problem and can best be solved by the national government. In principle I am a strong advocate of states' rights and duties and I deplore the recent tendency to have the federal government act as wet nurse for so many governmental babies whose rearing should remain with the states. In our case there is merit in the plan of having the state acquire the beach site and donate it to the federal government, the latter protecting, developing and maintaining the gift as a National Park for the benefit of all the people of all the states. Such a proposal is not without successful precedent. Essentially the same procedure in one form or another was resorted to in the case of our great national parks which, during this year, have been visited by about 3,000,000 people. It is estimated that during the same period over one hundred million people have found recreation on our beaches. In these days, when almost every family has its automobile and when other means of rapid transportation have been developed beyond the dreams of visionaries, our beaches have ceased to become local playgrounds and should no longer be treated as local problems.

"We all know that the millions who played on our beaches this year came not from the contiguous town, country or state, but from all over the nation. It seems to me unfair to ask the local community to acquire, protect and maintain a reasonable number of its beaches for the enjoyment largely of those who live at more or less great distance and who do not contribute to the taxes which make possible their enjoyment.

"The cost should be spread among the greatest number of persons who derive the benefit; and it seems to me the most equitable plan is the one I have suggested. For, under it, the smallest political subdivision, say, the town or county, contributes the lowest local taxes, a minor item; the state contributes the initial cost of acquiring the beach, not an undue financial hardship;

both town or county and state are relieved of costs of maintenance and supervision and are benefited by the additional money which a greater number of visitors will spend within the county and state while, finally, the burden of the cost of protection and maintenance, borne by the federal government, will be distributed among the whole nation, so that the contribution of each individual will be infinitesimal, and he will be helping to pay for that which is rightfully his to enjoy. I fear he will presently no longer have the opportunity of enjoying it, or only at much greater cost and under less pleasant conditions, unless we, the members of this association and our friends, further bestir ourselves to save for this nation that which inherently and essentially belongs to it.''

THE ACTIVITY OF WILD MICE

WILD mice are up and going all night and sleep in the daytime. But they can have the night-and-day rhythm of their lives dislocated by shifting the hours when the lights are turned on.

This has been learned by studies conducted by Dr. M. S. Johnson, of the University Farm at St. Paul, Minnesota, when he was at the University of Illinois. He was interested in the environmental factors that control the lives of two species of wild deer-mice. Since light is one of these factors he undertook to find out something about the way in which the mice respond to its changes.

In order to get an automatic record of their periods of activity and inactivity, he hung up cages containing mice on a harness of rubber bands. When the mice moved they made the cages jiggle. The cages were connected with pens that bore on paper disks traced by clockwork, so that whenever the jigglings occurred the smooth line on the paper was made correspondingly sawtoothed.

The records made by caged mice under otherwise normal conditions showed that they slept practically all day and were awake and active during most of the dark hours. Their active period was longest in winter, when the nights are longest. When they were put into a dark room and kept dark permanently, they continued to sleep while it was daylight outdoors, preserving their normal 24-hour rhythm.

But the rhythm could be broken by turning on the light during the night hours. By making an artificial day at night in the dark room, he finally succeeded in getting his mice to change the order of their sleeping and waking periods. Then, when he turned out the lights and left them in permanent darkness again, he found that they kept to the new rhythm, sleeping at night and conducting their murine affairs during the day.

But an attempt to hurry up the schedule of their lives, by shortening their ''day'' to sixteen hours, eight hours of darkness and eight of light, resulted only in confusing them completely. They then had no daily rhythm whatever, waking and sleeping at all sorts of irregular hours. However, when the lights were once more turned off, again restoring the friendly permanent dark, they went back to the even tenor of their 24-hour ways, sleeping eight hours and waking sixteen.

ITEMS

THE planet Pluto, most distant known member of the Solar System, is of approximately the same mass as the Earth. Dr. Seth B. Nicholson and Nicholas U. Mayall, of the Mount Wilson Observatory, have ascertained this fact by studying the way that Neptune, second most distant planet, is pulled out of its proper path by the Plutonian attraction. It was by a method similar to this that Neptune itself was discovered from its effect on the motion of Uranus. Pluto was discovered last spring by astronomers at the Lowell Observatory in Arizona, but it turned out to be much fainter than had been expected. The new work shows that it is more similar to the inner, or minor, planets, Mercury, Venus, Earth and Mars, than to its nearer neighbors, the major planets, Jupiter, Saturn, Uranus and Neptune. According to Dr. Nicholson's figures, Pluto is now about three and a half billion miles from the earth, but it is gradually coming a little closer.

DR. L. R. THOMPSON, of the U. S. Public Health Service, has told members of the House Appropriations Committee that approximately $17,278 will be needed for purchasing laboratory animals for the National Institute of Health in 1931. Wild rabbits can not be used because they are apt to have many different intestinal parasites, as well as tularemia (rabbit disease). Guinea-pigs for laboratory purposes cost around $.90 apiece; rabbits, $1.35; white mice, $.17; monkeys, $16.00; chickens, $1.85; pigeons, $.35; white rats, $.50; frogs, $.11, and cats, $.50. The establishment of an animal farm where the U. S. Public Health Service can raise and breed its own animals for study was suggested as a wise move by the House Committee on Appropriations.

THAT this year will mark a halt in the yearly increase in deaths from cancer is the hopeful prediction made by statisticians of the Metropolitan Life Insurance Co. who have been studying the figures so far available for 1930. If a halt does occur, it will be the first in five years. A slight but encouraging decrease in the number of cancer deaths this year has been found in their figures. From January to September, 1930, the cancer death rate among their white policyholders was 76.8 per 100,000 as compared with 77.2 for the same period in 1929. Diabetes, heart disease and Bright's disease also showed lower death rates so far for 1930. In fact the whole health picture is decidedly bright. ''Never before have such satisfactory health conditions prevailed in the United States and Canada as during the first nine months of 1930. Nineteen thirty, moreover, bids fair to be a year of best records, not only in the low mortality rate for all causes combined, but for several diseases which are of major importance, either numerically or in point of public health interest. The outstanding examples are tuberculosis, diphtheria, diarrheal complaints and puerperal conditions. The typhoid fever death rate also is running lower than ever before.''

SCIENCE NEWS

Science Service, Washington, D. C.

DISCOVERY IN CALIFORNIA OF IODINE

IODINE has been discovered in paying quantities in southern California. This comparatively rare chemical element has long been controlled by a South American monopoly which regularly maintains a "pegged" world price on the commodity at a high level. Industries concerned with an iodine supply during possible future war blockade are much interested in the local prospects.

Some time ago Los Angeles petroleum chemists, analyzing brackish waters from oil wells near Long Beach, California, discovered iodides in commercial quantity. So great is the mass of worthless salts associated with the iodine, however, that difficulty has been experienced in extraction of the desired product. At least one company, however, has attained some success with the problem, and California iodine is appearing on the market.

One of the favored methods of manufacture involves the treatment of the brine with nitrous acid which drives the iodine out of its salty compounds and permits it to be absorbed in activated charcoal much as war gases were caught in gas masks. Distillation of the loaded charcoal yields the precious product, which commands about four dollars per pound.

Iodine holds a queer economic position in chemical industry. To be sure, it goes into drugs, disinfectants, a few dyes, photographic supplies and a host of minor applications. Apparently nobody uses it in huge quantities, though very many persons require small quantities of the substance. Accordingly no one is seriously embarrassed if a monopoly charges several prices for the supply. The South American producers could furnish a very much larger quantity than that now marketed, but prefer to restrict trade and charge a high toll.

As yet the southern California production is not large enough seriously to threaten the monopoly, but with extension of oil drilling operations it is hoped that the business of producing iodine may be brought down into the domain of the law of supply and demand.

Iodine has two inexpensive chemical brothers, chlorine and bromine, which have taken over most of the large-scale duties which manufacturers might well have assigned to the more expensive element. Iodine is a solid, rather than a fuming liquid like bromine, or a corrosive gas like chlorine. There are accordingly many situations where chemical manufacturers would find it superior in technical use. As long as iodine is a hundred times as costly as free chlorine, and fifteen times as expensive as bromine, it can hardly make much industrial progress.

CONTROL OF THE JAPANESE BEETLE

WILD carrot, hated as a noxious weed by farmers and dairymen all over the country, has suddenly found a useful job. It affords a home and food to an insect newcomer brought to America from Japan to fight one of the most ravaging of pests, the Japanese beetle.

Two Bureau of Entomology workers, J. L. King and J. K. Holloway, describe the new insect ally of man and tell of the efforts, finally crowned with success, to get it firmly planted in its new home. They have found that the adult insects, which are little wasp-like creatures, make themselves at home in the flowers of wild carrot, feed there, and will not take kindly to any other plant. So it appears that a hitherto useless weed will become a necessary agent in combating Japanese beetle.

When the female of the new insect ally is ready to lay an egg, she locates the burrow where the grub of the Japanese beetle lurks and feeds. How she finds the buried grub is still a mystery; apparently she locates it by sense of smell.

Then she burrows down to the grub, and after stinging it into temporary insensibility, lays her egg on the underside of its body. The grub recovers from the sting and goes on feeding, but the egg, still attached by a kind of natural mucilage, finally hatches out.

The larva of the wasplet bites hold of the grub's body and sucks and sucks, growing bigger and bigger. At last the grub gives up the struggle and dies, whereupon the larva stops sucking and begins to chew, soon finishing off the carcass.

Then it spins a loose web of silk in the burrow and goes to sleep in this cocoon, emerging finally as a full-grown adult. The males emerge a few days before the females, so that when the latter appear above the surface their prospective mates are there on the lookout for them.

This early mating is an advantage in the propagation of the species, and is especially helpful to the entomologists who want to catch the insects and transplant them into other beetle-infested areas, because it can safely be assumed that every female found feeding in the wild carrot flowers will soon be ready to lay her eggs.

The insect was discovered in Japan, Chosen and China some years ago. Efforts have been under way for a decade to get it established in the beetle-infested parts of the United States, but it is only now that the Bureau of Entomology has become sufficiently well satisfied with the results to report success. Over 140 colonies of the insects have been released, mostly in the area around Philadelphia. It is expected that further work will spread the little insect to all parts of the Japanese beetle territory.

DRUGS FOR MALARIA

AT the Wellcome Chemical Research Laboratories, London, where remedies for tropical diseases are constantly under investigation, Dr. T. A. Henry and associates are taking advantage of a fact discovered many years ago, that birds as well as men are subject to malaria. So birds are being tried out as experimental animals for proposed new malaria cures, in place of the time-honored guinea-pigs, rabbits and dogs.

Although quinine has been the standard remedy for malaria ever since the Spanish missionaries learned its use from the Peruvians three hundred years ago, until within the last few years few efforts have been made to improve upon it or to find other tropical drugs that might be even more efficacious. Now investigators are at work on the problem from both these angles.

One of the promising chemical derivatives of quinine, Dr. Henry states, is an oxidation product, quitenine. It has no effect on malaria, but two of its compounds, the butyl and amyl esters of quitenine, are vigorous in their action against the parasites. However, the most promising derivative yet tested is the reduction product, hydroquinine.

A number of native malaria "cures" from different parts of the world are also under investigation. Alstonia bark has long enjoyed a high reputation in native medicine in Africa, the Pacific islands and Australia. Akuamma is another African remedy of high repute. Greenheart bark is favored by native doctors in British Guiana. Alkaloids have been isolated from all of these, but only those from Alstonia have shown any activity in bird malaria.

FOOD VALUE OF THE SWEET POTATO

SWEET potatoes are of higher food value than white potatoes, contrary to common belief. That the protein ipomoein of the sweet potato is richer in the nutritionally-essential amino-acids that compose proteins than the protein obtained from the white variety, has been shown by Dr. D. Breese Jones and his collaborators in the Bureau of Chemistry and Soils of the U. S. Department of Agriculture.

Proteins, those complex compounds of nitrogen, are a necessary constituent of any diet. Ordinarily we obtain our greatest amounts of these from meat, eggs or milk. Potatoes and sweet potatoes are more important as sources of starch or fuel-energy-giving material, as are also the cereal foods.

Potatoes of both kinds, however, contain proteins that are superior in nutritional quality to those of corn and white bread. They contain a greater proportion of the essential building materials for human nutrition.

The sweet potato has a further advantage. Dr. Jones has isolated and studied protein from seven or eight varieties. Not all of the nitrogen in white potato is due to protein, but to other substances of less food value. These are not found in the sweet potato.

The sweet potato is also very satisfactory in regard to its content of the essential vitamins. The common potato contains less vitamin A. Thus the sweet potato has much to recommend it as a balanced food.

The potato has been claimed by Dr. M. Hindhede, of Denmark, as the perfect food. The sweet potato is largely unknown in Europe though it was probably introduced there a hundred years before the common "spud." It is even mentioned in Shakespeare. It looks as if the Danish enthusiast might have to transfer his attention now to the all-American product.

Sweet potato flour can be added to wheat flour in making bread, with satisfactory results. A process has also been worked out by the Bureau of Chemistry and Soils for making syrup from sweet potatoes.

Sweet potatoes form one of the chief vegetable foods in the southern states. The Department of Agriculture suggests that a larger percentage of the crop than at present might be fed to farm animals as it constitutes a cheaper and more productive source of carbohydrate, or fuel-energy material than corn as a supplement to such protein concentrate feeds as cottonseed, peanut and soybean meals. The sweetness is due to the action of diastase, a substance present which changes the starch into sugar in the process of cooking.

A METEOR SHOWER SEEN FROM A SHIP AT SEA

AN "immense shower of meteors," or shooting stars, coming as fast as 12 to 15 a minute, was observed in the early morning hours of November 17, from a ship in the Atlantic Ocean near Porto Rico by Second Officer G. T. Bieling, of the American steamer *Annetta*. One was a brilliant fireball, that exploded in a flash so bright that an excellent flashlight photograph could have been taken by its light. This body left a luminous trail visible for 25 minutes afterwards.

In a report of the occurrence to the U. S. Navy's Hydrographic Office, Mr. Bieling said that the display lasted from about midnight, eastern standard time, to dawn. Their general course was from east to west, and they covered all parts of the sky. The greatest numbers of shooting stars were seen about 3:40 A. M., eastern standard time. This was the time of the regular November meteor shower, known to astronomers as the Leonids, because they seem to radiate from the constellation of Leo, the lion. Great showers of Leonid meteors were seen in 1799, 1833 and 1866. Another was expected in 1899, but failed to materialize, because the stream of meteors had been switched aside by the gravitational pull of Jupiter.

Astronomers have recognized the possibility of another great shower in November in the next few years, and thought that a good display this year might be a foretaste of such a shower. Generally cloudy weather over the United States, however, prevented extensive observations, though a few astronomers, especially in the Middle West, reported very large numbers on the early morning of the seventeenth. This was a day or so later than the usual time of maximum.

Mr. Bieling's report indicates that the Leonid shower this year was even greater than was supposed at the time. It is hardly likely that the maximum shower of Leonids would come as early as 1930, so the great cluster of Leonid meteors is probably approaching the earth's orbit. If this is the case, the next few years should see increasingly greater showers, with a really magnificent one about 1932 or 1933.

SYNCHRONIZED BROADCASTING

A DEMONSTRATION of the success of synchronized broadcasting—that is, broadcasting by two different stations of the same program on the same wave-length,

is afforded by two Iowa stations that have just completed six months of such operations. The stations are WHO, Des Moines, and WOC, Davenport. Glenn D. Gillett, engineer in the Radio Development Department of the Bell Telephone Laboratories, has just made a full report of the technical features of the system. He supervised its installation.

The stations are operated by the Central Broadcasting Company, of Iowa, and until last winter they shared time on a frequency of 1,000 kilocycles. The two cities are about 153 miles apart. Each station could only give effective service within a radius of about 50 miles, so neither city was able to receive satisfactory service all of the time, even though both stations might be broadcasting the same program.

Without special means of control, two stations can not keep on precisely the same frequency. They may keep close enough to the exact frequency assigned to satisfy the requirements of the Radio Commission, but very slight differences between them cause the two sets of waves to interfere, with disastrous results for the listener.

Since June 9, WHO and WOC have been synchronized, with the result that about 1,000,000 people, who formerly received adequate service from these stations about half the time, now receive it all the time. This is accomplished by means of a newly developed crystal control that is much more precise than older devices of the same kind.

However, it is not possible, even with this, to maintain absolute synchronism all the time, so a special listening station was established about half way between the two cities. WHO is the standard, and the monitoring station picks up the broadcast program, whence it is sent back to WOC by telephone wires. When WOC begins to vary from synchronism, this received program becomes slightly fainter, and the operator readjusts the transmitter. The adjustment is so delicate that a complete revolution of the control dial varies the WOC carrier frequency by but one part in a million. While broadcasting, an adjustment is made every 15 minutes.

Other broadcasters are also conducting experiments with synchronized broadcasting, and experts expect that it will soon come into general use. Thus a number of frequencies will be freed for other broadcasters, so that the crowded condition of the ether will be partly relieved.

ITEMS

SEVERE earth vibrations, known as "microseisms," which occurred for several days beginning on December 14, seem to be associated with the area of low atmospheric pressure that was travelling up the Atlantic coast at the time. The Rev. F. W. Sohon, S.J., in charge of the Georgetown University Seismograph Station, said that the vibrations were very marked, and would have prevented a satisfactory record of a real earthquake if one had occurred then. He stated, however, that while severe they were not extraordinarily so, but that they had often been observed in the past, of even greater intensity. He cited the opinion of his predecessor, the late Rev. F. A. Tondorf, S.J., that the low pressure area produces a shaking of the entire coast, which is recorded on the sensitive seismograph. Microseisms differ from earthquakes in that they are continuous, while the actual earthquake record is separated into well-defined phases. The microseism vibrations have a period of four or five seconds, while the earthquake waves are much longer.

THE four meteorological stations which the Sven Hedin Asiatic expedition established in the interior of Asia are being operated now by Chinese investigators. These stations, the only ones of their kind in an area as great as the continent of Australia, are gathering much information about the exchange of air currents between the polar regions and the equator. Three years ago, Dr. Hedin established the stations, and the meteorologists of his expedition started the work of sending up balloons filled with hydrogen gas, which were watched by telescopes. By this method, the air currents are being charted. Chinese students who accompanied the expedition were taught the methods and last year Dr. Hedin presented the stations, fully equipped, to the Chinese Government on condition that the service be maintained.

CHICKENS can now be protected from fowl pox, a highly infectious disease that often plays havoc with flocks, by a new vaccine made from pigeons. The vaccine was developed by Captain T. M. Doyle, of the Veterinary Laboratory, British Ministry of Agriculture. Fowls treated with it acquire immunity against fowl pox both under laboratory conditions and also in ordinary commercial practice. The immunity is fully established about the fourteenth day after inoculation. The vaccine does not give rise to any loss of condition or constitutional disturbance, nor does it seem to interfere with egg production. During the past six months, 50,000 doses of the vaccine have been given to infected fowls. The results were all excellent except in one case, and in that case it is just possible that the fowl was suffering from some disease other than fowl pox.

OF the women injured in industrial accidents, the greatest numbers are in the younger age groups, the U. S. Women's Bureau has found from a study of cases receiving employees' compensation in eight states. In Maryland, over 40 per cent. of the compensation claims allowed during one year were for accidents to young girls under 21 years of age. This number is out of proportion to the number of that age employed in industry, for census figures show less than 21 per cent. of employed women in Maryland to be under 20. In other states the proportion of injured under 21 years run from 25.5 per cent. in Massachusetts, to 37 per cent. in Georgia. Although fewer girls than boys were hurt, the proportion of young people was higher for the women. Young people were most often hurt by machinery; older ones by falls. The most serious injuries occurred in the laundry industry.

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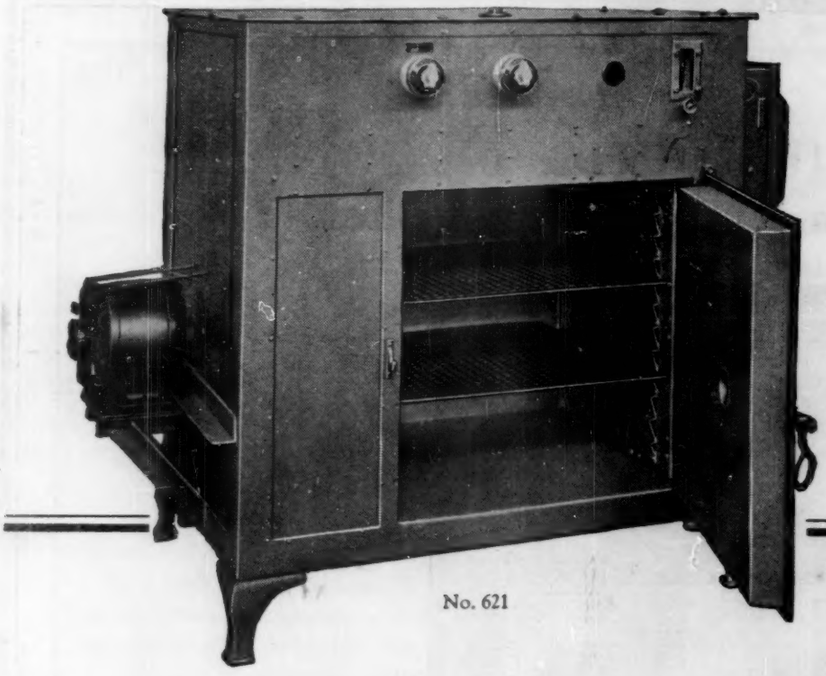

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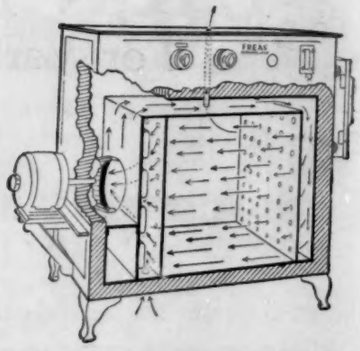

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